Relational Contracts, the Cost of Enforcing Formal Contracts, and Capital Structure Choice

Theory and Evidence

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Abstract

We explore the effects of the enforcement costs of legal contracts governing non-financial relationships between firms on corporate financing decisions. We derive a theoretical mechanism where higher costs of enforcing formal contracts make firms rely on informal relational contracts to govern their relationships. These relational contracts work better if firms use less debt financing. Using firm-level data and controlling for all relevant determinants of leverage, we test the prediction that higher costs of enforcing formal contracts are associated with lower corporate debt ratios. Our empirical analysis suggests that the results are indeed driven by the relational contract mechanism we propose.

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1. Introduction

It is generally recognized that legal institutions affect economic outcomes. But little is known about the channels through which institutions shape the specific components of a firm's organization such as its capital structure. This paper explores how the quality of one particular legal institution – the enforceability of legal contracts – affects a firm's financing decision. We make the empirical observation that higher costs of enforcing formal contracts, which govern *non-financial* relationships between firms, are negatively related to firms' leverage. We propose a theoretical mechanism to explain this outcome: Bad contracting institutions let more firms rely on informal relational contracts to govern their relationships, and these relational contracts work better if firms use less debt financing.

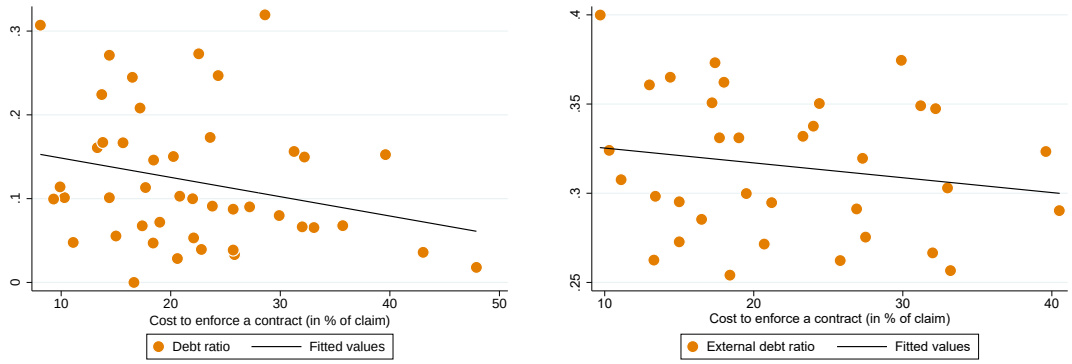
Our analysis is based on a measure of contract enforcement costs across countries provided by the World Bank in its Doing Business database. The variable *Cost to enforce a contract (in % of claim)* measures court costs, enforcement costs and average attorney fees associated with the resolution of a hypothetical commercial dispute between a seller and a buyer through a local court. Figure 1 plots average debt ratios across countries against the cost of enforcing a contract for two samples. Panel (a) is based on data from the Orbis database, where we measure the debt-to-capital ratio on the vertical axis. Panel (b) is based on data from the *MiDi* database, where we measure the external-debt-to-capital ratio on the vertical axis.[1]

There is a clear negative correlation between average leverage (measured as the mean debt ratio across all observations in a given country) and contract enforcement costs. The main contribution of our paper is to provide evidence that this unconditional negative relationship between debt-to-asset ratios and contract enforcement costs holds in panel data regressions, where all relevant determinants of leverage are controlled for. A large number of tests suggest that our findings are robust and consistent with theoretical considerations.

We theoretically derive a mechanism that can explain this outcome and has two main components: First, if costs of enforcing formal contracts are high, firms eventually find it optimal to use informal long-term agreements ("relational contracts") instead of formal contracts to govern their business relationships. Second, relational contracts are more effective if firms use less debt financing. We set up one particular model that generates this mechanism but note that other specifications can do so as well (our model is formally derived in Section 8 in Appendix II and verbally discussed

[1]Both graphs only report average values of debt ratios per country if the mean is based on at least 100 observations. This excludes some countries with very high values in the 'cost to enforce a contract'.

Figure 1: Correlation between debt and the cost to enforce a contract



(a) Mean debt ratio (*source: Orbis*)

(b) Mean external debt ratio (*source:* MiDi)

in the main part of the paper). The model we apply analyzes a buyer-seller relationship and picks up the main features of the hypothetical case behind the World Bank's Doing Business *cost to enforce a contract* measure. It assumes a dispute arising from the delivery of custom-made goods by the seller, for which the buyer refuses to pay, alleging inadequate quality. Subsequently, the seller sues the buyer referring to their sales agreement. An expert opinion is given and the judge decides that the quality of the good delivered is adequate and that the buyer must pay the contracted price. The total cost related to such a case includes all costs advanced by the seller to the court, to enforce the judgment, and to a local attorney regardless of final reimbursement.[2] We show that buyer and seller use formal contracts only if costs of formal enforcement are sufficiently low; otherwise, they rely on informal relational contracts. There, the buyer promises to reward the seller for the delivery of high-quality. This promise is credible if the buyer's future profits from continuing the relationship are sufficiently high, compared to the profits after reneging on this promise when the relationship terminates. Importantly, relational contracts restrict the use of debt financing. The reason is that interest payments reduce the buyer's future profits and therefore increase its reneging temptation in the relational contract (Fahn, Merlo, Wamser, 2019). Therefore, we conclude that relational contracts are associated with less debt financing than formal contracts, and predict that higher costs of enforcing contracts reduce firms' debt levels.

We test this prediction using firm-level panel data. In particular, we examine

[2]See http://www.doingbusiness.org/methodology/enforcing-contracts, for more details on how this case is constructed.

how the share of debt provided by external creditors relative to total assets is determined by the cost of enforcing a contract and other variables determining debt financing. We first show that there is a robust negative correlation between the debt ratio and the cost to enforce a contract, using the World Bank measure mentioned above for the latter. We then run first regressions exploiting almost 44 million firm-entity year observations, where the debt ratio is the dependent variable and the log of the cost to enforce a contract the explanatory variable (besides, we condition on country- and time fixed effects) and find a negative and statistically significant coefficient. We finally estimate dynamic panel models and add a large number of regressors. We are particularly careful in controlling for financial market determinants and other institutions affecting creditors, since these are potentially correlated with the enforcement costs of non-financial contracts. The dynamic panel methods as well as the large number of controls naturally reduce the number of observations in the analysis. Nevertheless, our basic sample still includes more than 4 million firm-entity-year data points. Our estimation approach also accounts for time-constant firm-entity-, industry-, time-, as well as country-specific effects, to make sure that parameter estimates are not confounded by aggregate time shocks or time-constant variables such as risk or financial contract cost. Given the fixed effects, the estimation approach fully relies on changes in the cost of enforcing contracts over time, which is typically driven by institutional reform.[3]

In line with our proposed theoretical mechanism, our baseline results confirm a small but robust and statistically significant negative effect of the cost of enforcing contract on debt financing. We provide additional tests and results based on alternative *(i)* cost-of-enforcing-contract measures, *(ii)* specifications, *(iii)* data, *(iv)* and estimation methods (e.g., non-dynamic OLS and fractional response models). We also provide empirical results in accordance with *(v)* features and predictions from our theoretical model. All findings are highly consistent and imply a robust impact of the contract enforcement cost on capital structure choice.

Quantitatively, our estimates suggest a long-run effect of about -0.038. Thus, a one-standard-deviation increase (0.32) in the formal cost to enforce a contract measure leads to a decrease of the debt-to-total asset ratio of about 1.2 percentage points ($-0.038 \times 0.32 = 0.0122$). We observe a number of institutional reforms in our data producing variation of similar magnitude in the enforcement cost.

Our empirical analysis suggests that the results are driven by the relational contract mechanism we propose. Our paper more generally shows that the *quality of*

[3]We observe a significant number of changes in the measure of 'cost to enforce a contract' over time, which are mostly related to institutional reforms. See Table 8 in Appendix I for detailed information.

institutions can have an indirect effect on a *firm's organizational structure*, because both aspects influence a firm's relationships with its stakeholders.

2. Related Literature

This paper relates to the corporate finance literature. Existing theories of a firm's optimal capital structure seem to do an insufficient job in explaining why many healthy and profitable firms rely heavily on equity financing, even though benefits associated with debt (like tax shields) appear to be high and the bankruptcy risk low (Graham, 2000; Strebulaev and Yang, 2013). Most approaches focus on how different modes of financing affect the owners of a firm, its managers, and (potential) providers of external capital. More recently, there has been a growing awareness that a firm's optimal capital structure is also affected by its relationships with non-financial stakeholders – such as employees or suppliers. In a survey article, Graham and Leary (2011) call for new approaches to explain a firm's optimal capital structure considering interactions with non-financial stakeholders. Early approaches in this direction include Titman (1984), Maksimovic and Titman (1991), or Berk, Stanton, and Zechner (2010). More recently, a number of papers have established that a firm's capital structure might interact with informal components of a firm's incentive system. Fahn et al. (2019), or Barron, Li, and Zator (2022) show theoretically that relational contracts work less smoothly if a firm uses more debt financing.[4] This is because the performance of relational contracts is determined by the size of future quasi-rents stemming from the respective relationship. Debt reduces those quasi-rents because of the associated payments to creditors.

Our paper is also related to the (small) literature on costs of enforcing formal contracts. These papers analyze the relationship between firms and its final customers, where costly litigation can be used as an incentive device for firms to provide high-quality products, but where firms also have the possibility to build up a reputation. Bakos and Dellarocas (2011) show that if quality can be low even if high effort has been provided, a reputation mechanism is generally inferior to a litigation mechanism. Ganuza et al. (2016) suggest that a better-functioning litigation mechanism generally also improves the reputation mechanism, and Baker and Choi (2016) show that the interaction between formal contracts and reputation can also be driven by information from past litigation cases.

In a different vein, a number of important contributions (cf. Baker et al., 1994) have analyzed different degrees of verifiability of performance measures. If some performance measures are verifiable whereas others are not, formal and informal

[4]See Malcomson (2013) for a great overview on relational contracts, and Gibbons and Henderson (2013) for a thorough reasoning for why the appropriate handling of relational contracts is crucial for a firm's success.

arrangements (i.e., relational contracts) can be substitutes if the former serve as outside options for a relational contract. We do not consider different degrees of verifiability, but rather assume that external enforcement of a contract is feasible but costly.

Finally, our paper relates to the growing literature on the role of institutions for economic outcomes. Institutions are recognized to be a key determinant of long-term growth (Acemoglu et al., 2005), financial development (La Porta et al., 2008), and international trade (Nunn and Trefler, 2014). We contribute to this literature by adding to the understanding of the precise channels through which legal institutions affect market outcomes, in our case the financing decision of the firm. Most papers linking legal institutions to capital structure focus on the effect of investor protection and creditor rights. Shleifer and Wolfenzon (2002) summarize empirical evidence and show that it is consistent with an agency model of corporate finance where external financing is determined by the quality of investor protection. Contract enforcement efficiency has been analyzed in the context of debt enforcement, and has been found to be correlated with debt market development (Djankov et al., 2006). Nunn (2007) finds that the quality of contract enforcement determines a country's trade patterns: countries with good contract enforcement specialize in industries for which relationship-specific investments are most important. Boehm (2013) finds that in countries with high enforcement costs, the sectoral use of inputs relying heavily on contract enforcement is lower. All these studies rely on cross-sectional variation across countries or countries and industries to identify the link between legal institutions and economic outcomes.

We are, to the best of our knowledge, the first to explore the link between the cost of enforcing contracts governing non-financial relationships between firms, incentives and the capital structure of the firm. To identify the effect empirically, we exploit micro-level panel-data. This allows us to control for observed and unobserved firm-, industry-, and country characteristics.

3. Theoretical Analysis

In Section 8.1 of Appendix II, we formally derive a theoretical mechanism that can rationalize the observation that higher costs of enforcing *non-financial* contracts induce firms to use less debt. This model captures the setting that is used to derive cost of enforcing contracts in the Doing Business database. Note that alternative specifications of models can generate the same predictions, as long as a worse quality of contracting institutions induces parties to rely on relational contracts. We further discuss this aspect below, at the end of this section. Here, we provide a summary of

our model which adapts the setting introduced by Fahn et al. (2019) to the situation we analyze empirically.

We consider two firms, a downstream party and an upstream party, who interact repeatedly over an infinite time horizon. The downstream party needs two inputs to operate, a physical investment good and an intermediate good that can only be produced by the upstream party. The physical investment good is obtained once, at the beginning of the game, and can be financed either with equity or (short-term) debt.[5] The intermediate good is needed in every period. Its quality is either high or low, and producing high quality is costly for the upstream firm. The downstream firm obtains and then transforms the intermediate good into a final product, which however only is of value if the intermediate good's quality has been high. Both the investment and the intermediate good have no outside value, an assumption that does not affect our qualitative results as long as these values are larger within than outside the relationship.

Credit Market In case it wants to use debt to finance the upfront investment, the downstream party can enter a perfectly competitive credit market where all potential creditors are risk neutral (thus, we focus on external debt). If the downstream party decides to default on interest or amortization payments, its business is liquidated at the end of the given period. We assume that the direct costs of using debt and equity are identical, hence do not consider tax benefits of debt (which we analyze in Appendix II, in Section 8.6), or agency costs of external equity (see Fahn et al., 2019). Instead, we are going to identify indirect costs of debt that stem from the interactions of the downstream party with creditors and the upstream party. This implies that we will not solve for the uniquely optimal financing structure, but instead for *maximum* debt levels that, if exceeded, would induce the downstream party to default. If we considered direct benefits of debt such as tax shields, the maximum debt thresholds would indeed constitute the uniquely optimal debt levels. Therefore, we will then predict that firms facing lower maximum thresholds will also have lower (external) debt shares.

Contractability In every period, the downstream party offers a contract to the upstream party that involves (fixed and discretionary) compensation and the desired quality level; because low quality has no value, we focus on arrangements that aim at implementing high quality. The parties can use formal spot contracts or relational contracts (or a combination of both) to enforce their agreement.

[5] In Section 8.7 in Appendix II, we show that our results still hold if the upstream firm also needs an investment good and must finance it.

Formal Enforcement Formal enforcement is costly and carried out by a court that is able to determine the quality of the intermediate good and whether contractually specified payments have been made. In particular, if the downstream party withholds payment of the price and wrongly claims that quality is low, the upstream party can sue the downstream party to still extract the promised payment, however at (net) enforcement cost $K > 0$. This implies that only if enforcement costs are lower than the contracted price (which we assume cannot exceed the value the intermediate good has for the downstream party; see the discussion in Section 8.4 in Appendix II), formal contracts can incentivize both parties to conform. In that case, enforcement costs never materialize, and formal enforcement clearly is an optimal tool to govern the relationship. Therefore, we suggest that formal enforcement is used whenever optimal. Then, the maximum debt threshold is determined by a comparison of today's repayment obligations with future profits.

Enforcement with a Relational Contract If enforcement costs K are too high for a productive relationship solely based on formal enforcement, the parties may form a relational contract. A relational contract is an informal arrangement between the downstream and the upstream party which specifies payments and desired quality levels. There, high quality can be enforced if the downstream party finds it optimal to compensate the upstream party accordingly, instead of reneging and shutting down. Put differently, the downstream party will only make a promised payment if the future benefits of an ongoing cooperation are sufficiently high relative to a termination. This trade-off is at the center of relational contracting models and in our setting affected by the amount of debt the downstream party uses to finance the upfront investment: Upon reneging on a payment to the upstream party, the downstream party would find it optimal to also default on any outstanding amortization or interest payment – because it would subsequently shut down anyway. This implies that debt decreases the difference between profits from the ongoing cooperation and between profits after a default, and consequently reduce the downstream firm's willingness to make a payment to sustain the cooperative relationship. Thus, more debt reduces the parties' ability to enforce high quality with a relational contract, and the maximum debt threshold is smaller than if formal enforcement is used. Note that, for intermediate levels of K, a combination of formal and relational contracts is optimal which is further explored in the formal analysis in Appendix II. For this combination, the maximum debt thresholds is between the levels of formal and relational enforcement.

Main Prediction If firms operate in an environment with high formal enforcement costs K, more of them will have to rely on relational contracts and face a relatively low maximum debt threshold, compared to an environment with low formal enforcement costs and a higher threshold.[6] Moreover, as mentioned above, if we also considered benefits of debt such as its tax-deductibility, these thresholds would constitute uniquely optimal debt levels (see Section 8.6 in Appendix II). These arguments allow us to generate our main empirical prediction.

Prediction 1: *The higher the costs of enforcing formal contracts in a country, the lower are the debt shares of firms.*

Risk In the corporate finance literature, exposure to risk is regarded as an important factor determining a firm's optimal capital structure. Although our theoretical model does not explicitly account for risk, we can use the size of the discount factor as a proxy. In dynamic games, the discount factor is not only perceived to represent time preferences, but also to capture the probability with which a relationship continues (see Ahammer et al., 2023, for an application of this idea). Therefore, we argue that a riskier environment is represented by a lower discount factor. In our model, such a lower discount factor reduces the current value of future profits, thus decreases the downstream party's willingness to sacrifice current payoffs (i.e., repaying debt and, in a relational contract, compensating the upstream party) to sustain these future profits. Moreover, whereas a lower discount factor reduces the maximum debt in all enforcement regimes, this interaction is weaker in a relational contract, i.e., when enforcement costs are high. The reason is that future profits then not only have to cover the cost of repaying debt (as with formal enforcement), but also the cost of compensating the upstream party. Hence, maximum debt is less responsive to changes in the discount factor. This generates our second prediction.

Prediction 2: *Firms have less debt in a riskier environment. This negative link is less pronounced if costs of enforcing formal contracts are higher.*

The proof to Predictions 2 in Section 8.5 Appendix II.

[6] Our claim that firms in countries with higher enforcement costs rely more on relational contracts is supported by Besley (2015), who states that a "robust finding in the Doing Business report is that the countries which have a higher rank tend to have smaller informal sectors. This pattern suggests that the choice to become a formal firm may be a key margin affected by business regulation and formal laws [...]. But for that very reason, the way in which business conditions affect the extensive margin between whether firms choose to be formal and informal may be more important than how such rules affect the behavior of the formal sector taken alone." (Besley, 2015, p. 107).

Discussion of Setup Note that this specific setting is not needed to generate the result that better contracting institutions allow firms to use more debt financing. For example, consider Martimort et al. (2017) whose model also considers a repeated buyer-seller relationship where the latter has to provide a certain quantity in every period (moreover, the seller's production costs vary and are private information). Martimort et al. (2017) allow parties to fully commit to a long-term contract stipulating a trade profile. If a party breaches the agreement, it must pay an exogenously given remedy, after which the contract is terminated (i.e., there is no renegotiation). The size of such a remedy is an indicator of the quality of contracting institutions and constitutes an additional punishment to the party who breaches the agreement, on top of a termination of the relationship.[7] Thus, high remedies allow parties to exclusively use formal enforcement, low remedies force them to mostly rely on relational contracts. This implies that, if better contracting institutions allow for higher remedies, the seller-buyer relationship is less dependent on the future relationship surplus to incentivize cooperation today. Instead, although Martimort et al. (2017) do not consider a firm's financing structure, this future surplus could then be used for incentives to repay debt. Therefore, such a setting would also generate the prediction that better contracting institutions are associated with more debt financing.

4. Empirical Analysis

We test our main empirical prediction by estimating the impact of contract enforcement costs on (external) debt financing using firm-level panel data.

We primarily focus on the effects of the variable 'cost to enforce a contract (in % of claim)', $COEC_{jt}$, taken from the World Bank's Doing Business database. This variable is measured at the level of country j and year t. The World Bank obtains this measure by computing the cost of a hypothetical case of a commercial legal dispute between a seller and a buyer.[8] The dispute arises from the buyer's refusal to pay for a delivered customized good because of inadequate quality. The seller sues the buyer referring to their sales agreement. An expert witness is called, the judge confirms that the goods are of adequate quality, and the final judgment is in favor of the seller. The buyer must pay.

[7] Importantly, Martimort et al. (2017) demonstrate that the ability to commit to long-term contracts has no consequences in the case without asymmetric information about the seller's production cost (which most closely resembles our setting); then, higher remedies merely increase the punishment imposed on the party that violates the relational contracts.

[8] See http://www.doingbusiness.org/methodology/enforcing-contracts, for more details on how the hypothetical case is constructed.

The variable provided in the Doing Business database measures costs related to such a case including court costs, enforcement costs, and average attorney fees. In its Doing Business report, the World Bank provides examples on reforms that have affected the costs of enforcing a contract in selected countries. For example, the World Bank reports that China increased the procedural efficiency at the main trial court in 2012 and particularly "made enforcing contracts easier by amending its Code of Civil Procedure to streamline and expedite court proceedings". In the same year, Côte d'Ivoire created a specialized commercial court that brought along reductions in the costs of enforcing a contract.[9] We provide more examples of changes in the cost of enforcing contract variable in Appendix I. Over all years available, the data suggest that in 74 cases reforms at the country level have increased the $COEC$ variable; in 64 cases reforms have decreased it.

Our dependent variable is the debt-to-asset ratio, DR_{it}, of firm-entity i at time t. We calculate DR_{it} by using information from Orbis, a micro-level dataset providing information on firms' balance sheets. To be more precise, we calculate our dependent variable as the ratio of the 'non-current liabilities' divided by the total assets.[10] As it seems crucial to distinguish between external and internal debt financing (in particular the consequences of a default may differ), we focus on domestic firms and basically exclude multinational corporations operating internal capital markets with cross-border lending and borrowing across countries and affiliates.[11] The grand mean of DR_{it} over all 4,034,253 observations in our estimation sample (see below) is 0.169 (std.dev.: 0.208); over time, the yearly average goes down by about 3 percentage points from 0.18 (std.dev.: 0.259) in 2010 to 0.15 (std.dev.: 0.244) in 2018.

The unconditional correlation between the two central variables of our study, DR_{it} and $COEC_{jt}$, is relatively strong: -0.192. A simple regression of DR_{it} on the log of $COEC_{jt}$ (the two central variables in this study), as well as country- and aggregate time fixed effects, suggests a coefficient of -0.020 (std.err.: 0.00073).[12] In our empirical analysis, we add a large number of firm- as well as country-specific control variables and specify the following regression equation:

[9]The World Bank's yearly Doing Business reports provide a large number of examples on how countries affected the costs of enforcing a contract by implementing institutional reform.

[10]The non-current liabilities have been used in the literature before to calculate debt ratios (see, e.g., Mc Auliffe et al., 2022, for recent work). Note that, while an earlier version of the paper (Fahn et al., 2017) has utilized alternative micro-level data (the *MiDi* database), Orbis has a number of advantages to address our research question, which we discuss later in this section.

[11]We provide robustness results, however, including multinational firms as well.

[12]This regression is based on almost 44 million observations and 7,107,895 firm-entities i located in 128 countries. We lose quite some observations by including a large number of controls and a dynamic panel approach.

$$DR_{it} = \gamma \cdot \widehat{DR}_{it-1} + \alpha \cdot COEC_{jt} + \mathbf{X_{it}} \cdot \kappa + \mathbf{Z_{jt}} \cdot \mu + \psi_i + \lambda_t + \epsilon_{ijt} \quad (1)$$

The inclusion of the lagged dependent variable in the specification above addresses the persistence in a firm's financing structure. Note that we transform equation (1) by first-differencing all regressors. This transformation eliminates unobserved i-specific heterogeneity ψ_i, and all time-constant country- as well as industry- fixed effects. The variable $\widehat{DR}_{it-1}$ indicates that the differenced lagged dependent variable is instrumented with its twice lagged level, following Anderson and Hsiao (1982). Tests on the optimal number of lags suggest that, given our data, three lags should be included (see below). Besides aggregate time effects λ_t, equation (1) includes a large number of entity-i- ($\mathbf{X_{it}}$) as well as country-j-specific ($\mathbf{Z_{jt}}$) variables; κ and μ are the corresponding coefficient vectors. Given our interest in isolating the effect of contract enforcement costs, we particularly need to control for other institutional aspects that might determine debt financing and which are likely to be correlated with our measure of contract enforcement costs.

Besides the three lagged dependent variables that ultimately enter equation (1) (i.e., $\widehat{DR}_{it-1}$ to $\widehat{DR}_{it-3}$),[13] and the firm-entity i as well as aggregate time fixed effects (ψ_i and λ_t in (1)), we always condition on two additional variables taken from the World Bank's Doing Business database. The first variable is the *Getting Credit Score*, GCS_{jt}, the second one is the *Protecting Minority Investors Score*, $PMIS_{jt}$. Both variables should capture variation in the costs of financial contracts and access to finance at location j and time t, which seems crucial in our context.[14] Both indicators possibly range between 0 and 100. The mean values in our estimation sample are about 61 (GCS) and 63 ($PMIS$).

As for the additional control variables in $\mathbf{X_{it}}$ and $\mathbf{Z_{jt}}$, our specification closely follows the recent study by Goldbach et al. (2021). We usually condition on the following time-varying affiliate-, and country-specific characteristics: $log\ SALES_{it-1}$, $log\ EMPL_{it-1}$, $PPTA_{it-1}$, $TANG_{it-1}$, TAX_{jt}, GDP_{jt}, $GDPpc_{jt}$, $GDP\ growth_{jt}$, $INFL_{jt}$, $CORRUPT_{jt}$, $log\ DCP_{jt}$, ROL_{jt}, as well as GCF_{jt}. The first four i-specific variables are calculated using information from *Orbis*. They all enter as lags $(t-1)$ to address endogeneity concerns.

[13] The 'hat' notation indicates that we account for dynamic panel bias by instrumenting the first-differenced regressors with twice lagged level variables (see Anderson and Hsiao, 1982).

[14] The scores include 'the strength of credit reporting systems and the effectiveness of collateral and bankruptcy laws in facilitating lending' as well as 'the strength of minority shareholder protections against misuse of corporate assets by directors for their personal gain as well as shareholder rights, governance safeguards and corporate transparency requirements that reduce the risk of abuse' (see the World Bank's Doing Business data).

The log of the sales of entity i, $log\ SALES_{it-1}$, is included to capture size effects. Size is expected to be positively related to the ease of borrowing from external creditors (e.g., Graham and Harvey 2001; Frank and Goyal, 2009). The variable $log\ EMPL_{it-1}$ might also capture size but is generally a relevant control in the context of relational contracts. The effect we expect is thus also positive.

Previous studies further condition on some type of profitability measure. We use $PPTA_{it-1}$, the lagged operating profit and loss divided by operating revenues. In case firms report a loss, we set this ratio equal to zero. We then take the log of the variable (adding 1 to not lose the zeros) as it contains substantial variation. Huizinga et al. (2008) argue that profitable firms may be associated with less risk, and thus have a better access to the credit market, suggesting a positive relationship between debt financing and $PPTA_{it-1}$. As an additional i-specific control we include $TANG_{it-1}$, calculated as the ratio of fixed assets to total assets of entity i. A higher share of fixed assets might imply easier access to external debt because fixed assets are used as collateral (Rajan and Zingales, 1995). However, high tangibility could be associated with more depreciation allowances and investment tax credits for investment in fixed assets. This might crowd out the value of the debt tax shield, in which case the impact of $TANG_{it-1}$ on debt would be negative (see De Angelo and Masulis, 1980).

Beside the two above-mentioned j-specific variables GCS_{jt} and $PMIS_{jt}$, we control for a selection of time-varying country-specific regressors to capture general economic conditions at j and also local institutions such as creditor rights, as well as financial market conditions: TAX_{jt}, GDP_{jt}, $GDPpc_{jt}$, $GDP\ growth_{jt}$, $INFL_{jt}$, $CORRUPT_{jt}$, $log\ DCP_{jt}$, ROL_{jt}, as well as GCF_{jt}.

TAX_{jt} is the local statutory tax rate, which is expected to positively affect DR_{it} as interest on debt is tax deductible (Desai et al., 2004; or Buettner et al., 2009). The statutory corporate tax data is taken from the Research School of International Taxation's (RSIT) International Tax Institutions (ITI) database (Wamser et al., 2023). The idea of including GDP_{jt}, as well as $GDPpc_{jt}$, is to capture j-specific market conditions, a country's size (GDP) and its level of development (GDP per capita). These variables may be correlated with numerous country-specific factors such as local access to debt financing. We control for $GDP\ growth_{it}$, which measures annual growth of a country's GDP. If a higher value of $GDP\ growth_{it}$ is associated with future growth, the effect on borrowing should be positive (Harris and Raviv, 1991). Rajan and Zingales (1995) as well as Myers (2001) suggest using the market-to-book-ratio of a firm as a proxy for growth opportunities. In line with the debt-overhang theory of Myers (1977), they find that their measure is negatively related to borrowing. While market-to-book-ratios are not available in Orbis, we use $GDPgrowth$ as

a proxy variable. *GDP growth*, *GDP percapita* as well as GDP are taken from the World Bank's World Development Indicators.

$INFL_{jt}$ measures average percentage changes in consumer prices and is provided by the IMF (World Economic Outlook database). Huizinga et al. (2008) as well as Aggarwal and Kyaw (2008) argue that countries with higher inflation tend to have a higher risk premium and higher business risk in general, which discourages external borrowing. The variable $CORRUPT_{jt}$ is provided by the World Bank (Worldwide Governance Indicators). It measures *control of corruption* as "perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests" (see World Bank, Worldwide Governance Indicators). It varies in an interval of -2.5 to 2.5, higher values indicating less corruption. We expect that less corruption (an increase in $CORRUPT_{it}$) is associated with a lower external debt-to-asset ratio. If more corruption is associated with more political risk, our reasoning is in line with the findings of Desai et al. (2004) who argue that more risk should lead to more external debt financing as some of the risk may be shifted to external capital providers.[15]

The next variable is DCP_{jt}, which is also taken from the World Bank's World Development Indicators database, measures domestic credit provided to the private sector relative to country's GDP. Higher values thereof suggest a deeper capital market. Higher values of DCP_{jt} should be associated with a higher degree of financial depth and a more favorable (local) capital market, facilitating external debt financing (see also Levine and Zervos, 1998; Levine, 2005). ROL_{jt} ('rule of law') is a country-specific indicator taken from the World Bank's Worldwide Governance Indicators database and captures "perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". It captures the general economic situation and the quality of institutions in country j. We finally include the variable Gross Capital Formation GCF_{jt}, also from the World Bank's World Development Indicators database, which is measured in % of GDP, as an additional $j-$specific proxy for a country's economic structure.

Table 1 reports descriptive statistics on the variables described above and used in the empirical analysis.

[15]See also Kesternich and Schnitzer (2010), as well as Desai et al. (2008), for similar arguments; Aggarwal and Kyaw (2008) make the point that this is particularly true if corruption means that there is an increased risk of expropriation.

Table 1: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
$log\ COEC_{jt}$	4,034,253	3.077	0.320	2.175	4.202
$COEC_{jt}$	4,034,253	22.838	7.481	8.800	66.800
GCS_{jt}	4,034,253	61.087	12.846	10.000	100.000
$PMIS_{jt}$	4,034,253	63.163	7.972	24.000	86.000
$log\ SALES_{it-1}$	4,034,253	13.538	2.368	0.000	25.750
$log\ EMPL_{it-1}$	4,034,253	2.205	1.332	0.000	13.017
$log\ PPTA_{it-1}$	4,034,253	0.0698	0.116	0.000	13.157
$TANG_{it-1}$	4,034,253	0.258	0.270	0.000	1.000
TAX_{jt}	4,034,253	0.247	0.069	0.000	0.444
$log\ GDP_{jt}$	4,034,253	27.465	1.250	21.898	30.744
$log\ GDPpc_{jt}$	4,034,253	10.467	0.334	8.361	11.666
$GDP\ growth_{jt}$	4,034,253	1.558	2.152	-15.136	11.200
$INFL_{jt}$	4,034,253	1.394	3.723	-1.736	48.700
$CORRUPT_{jt}$	4,034,253	0.516	0.703	-1.131	2.337
DCP_{jt}	4,034,253	89.250	33.951	15.386	192.102
ROL_{jt}	4,034,253	0.727	0.621	-1.141	2.130
GCF_{jt}	4,034,253	20.471	3.938	11.892	44.309

Notes: The table provides descriptive statistics on the basic sample (see Table 2) using Orbis.

5. Results

Table 2 presents the basic results. Let us first provide some general information on the estimates. As mentioned above, our estimation approach follows the suggestion by Anderson and Hsiao (1982): we first apply a first-differencing transformation to equation (1) and include three lagged dependent variables, $\widehat{DR}_{it-1}$, $\widehat{DR}_{it-2}$, and $\widehat{DR}_{it-3}$, which are instrumented using lagged levels thereof. While Table 2 shows coefficient estimates on the three lagged dependent variables in a plausible range, we first test for the optimal number of lags by running regressions with one, two and finally three lags. After each regression, we run Arellano-Bond tests for autocorrelation (Arellano and Bond, 1991). These tests suggest that the null of no autocorrelation of order 1 can be rejected, and the null of no autocorrelation of order 2 cannot be rejected in case we include 3 lags of the dependent variable,[16] implying that this is the optimal dynamic specification.[17]

Our preferred measure to capture 'enforcing contracts' is $COEC_{jt}$, the 'cost to enforce a contract (in % of claim)'. This seems to be a particularly attractive variable given the hypothetical business case described above and also because it is a precisely defined cost measure in percent of claim. However, the World Bank also provides a total score, which we denote $TSCORE_{jt}$. This score ranges between 20.82 and 93.36 in our data (mean value: 67.23) and is determined by three components. First, by the $COEC_{jt}$, which we have described in detail above. Second, by the 'time (in days)' to enforce a contract. We denote the latter variable by $TIME_{jt}$. The maximum $TIME_{jt}$ in our data is equal to 1,711, the minimum is 120; on average $TIME_{jt}$ equals 555.36 days. Note that, in our theoretical model, a longer time to enforce a (formal) contract would be equivalent to higher enforcement costs and consequently generate the same prediction. Third, by the 'quality of judicial processes index', QJP_{jt}. The latter measure ranges from 0 to 18. Since QJP_{jt} is provided by the World Bank only since 2016 as a single variable, we will not use it in our basic specification, but provide one additional result below.

Note that there are quite some differences across countries in terms of $TSCORE_{jt}$, $COEC_{jt}$, and $TIME_{jt}$. For example, in South Korea, the 2018 value of $TSCORE$ is equal to 84.15, while $COEC$ equals 12.7 and $TIME$ is 290 days. In the same year, we observe values of 34.29 ($TSCORE$), 45.8 ($COEC$) and 1,288 ($TIME$) for Colombia. It is important to emphasize, however, that our empirical approach

[16]The corresponding test statistics are AR(1): $z = -231.74$ $Pr > z = 0.000$ and AR(2): $z = 0.78$ $Pr > z = 0.435$.

[17]Table 4 below provides additional results excluding the lagged dependent variables as well as Arellano-Bond (1991) regression specifications.

exploits variation over time in these variables, as the variation across countries is captured by ϕ_i (see equation (1)). And indeed, we observe some significant changes in these measures over time. For example, from 2013 to 2014, $COEC$ in Italy goes down by -6.8; in Estonia, we observe an increase of +5.4 from 2009 to 2010. Table 8 in Appendix I suggests that changes in $COEC_{jt}$ are typically related to institutional reforms.

Overall, our panel data analysis is based on 4,034,253 observations. The dataset is unbalanced, but we provide tests using a balanced version, showing that the findings are fully robust to that (of course, this reduces the number of available observations; see Table 5, where we restrict the number of years and provide results based on a balanced sample). Our basic sample excludes multinational corporations as intrafirm transactions might possibly confound our results (see Table 5, for robustness results including multinationals).

Note that including the lagged dependent variables naturally removes a lot of variation in DR_{it}. This explains that many of the country-level controls (such as the local tax rate) are insignificantly related to DR_{it}, even though the coefficient shows the expected (positive) sign. For reasons of brevity, we therefore make complete tables including all country-level coefficients available upon request. In some specifications in Table 2, $PMIS_{jt}$ is statistically significant at the 10-percent level: a higher *protecting minority investors* score is associated with a higher debt ratio. Apart from $log\ EMPL_{it-1}$, the i-specific variables are statistically significant and may be interpreted in light of the arguments provided above.

We generally take logs of the variables $TSCORE_{jt}$, $COEC_{jt}$, and $TIME_{jt}$. All results remain robust when including the variables in levels (see Table 7 in Appendix I). Table 3 displays the pairwise correlation coefficients between the three key variables. It suggests a negative correlation between $log\ TIME$ and $log\ SCORE$, $log\ COEC$ and $log\ SCORE$. As expected, $log\ TIME$ and $log\ COEC$ are positively related.

Since 2016, the Doing Business data also provide a 'quality of judicial processes' index (QJP_{jt}), as mentioned above. Since our panel consists to a large extent of observations before 2016, we do not use this variable for our basic results. However, a regression analysis using QJP_{jt} and the same regressors as before suggests a positive (as expected) but insignificant coefficient of 0.010 (std.err.: 0.010) on QJP_{jt}. And naturally, the number of observations is reduced substantially to 1,555,787. What we want to highlight here is that all results using alternative indices and measures provide a consistent picture on the effect of enforcing contracts on debt choices. On the following, we will focus on the variable $COEC_{jt}$, which allows us to interpret the findings in the most adequate way.

Table 2: Basic Results

	(I)	(II)	(III)	(IV)	(V)
$\widehat{DR}_{it-1}$	0.691***	0.691***	0.690***	0.690***	0.690***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
$\widehat{DR}_{it-2}$	0.062***	0.062***	0.062***	0.062***	0.062***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)
$\widehat{DR}_{it-3}$	0.013***	0.013***	0.013***	0.013***	0.013***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
$log\ SCORE_{jt}$	0.017**	0.014*			
	(0.008)	(0.008)			
$log\ COEC_{jt}$		-0.005	-0.009**	-0.009**	
		(0.004)	(0.004)	(0.004)	
$log\ TIME_{jt}$				-0.001	-0.002
				(0.006)	(0.006)
$log\ SALES_{it-1}$	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$log\ EMPL_{it-1}$	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$PPTA_{it-1}$	0.024***	0.024***	0.024***	0.024***	0.024***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$TANG_{it-1}$	-0.084***	-0.084***	-0.084***	-0.084***	-0.084***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
GCS_{jt}	0.001	0.001	0.000	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$PMIS_{jt}$	0.000	0.0002*	0.000	0.0002*	0.000
	(0.000)	(0.0001)	(0.000)	(0.0001)	(0.000)
Country-level controls	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES
Firm-entity effects	YES	YES	YES	YES	YES

Notes: The Table presents estimation results, based on 4,034,253 observations from Orbis. Dynamic panel estimates following Anderson and Hsiao (1982). The dependent variable refers to the debt-to-asset ratio, DR_{it}, of firm-entity i at time t. Robust and clustered (by country) standard errors reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table 3: Correlations – Alternative Enforcing Contract Measures

	$log\ COEC_{jt}$	$log\ Score_{jt}$	$log\ Time_{jt}$
$log\ COEC_{jt}$	1.000		
$log\ Score_{jt}$	-0.484	1.000	
$log\ Time_{jt}$	0.326	-0.878	1.000

Table 2 suggests that the estimated coefficient on $log\ COEC_{jt}$ is negative and significantly related to DR_{it}. This is what we expect. Quantitatively, a one-standard-deviation increase in $log\ COEC_{jt}$ is associated with a decrease in firms' debt-to-asset ratios of 0.00288 ($0.32 \times 0.009 = 0.00288$). While this effect appears to be very small, we should bear in mind that some institutional reforms affect $COEC_{jt}$ substantially. Moreover, for the sake of the empirical analysis, we remove all cross-country differences in $COEC$ so that any cross-sectional variation does not contribute to this effect. Note that the long-run effect, considering the lagged dependent variables, is larger by a factor of 4.[18]

5.1. Robustness tests

In Tables 4 and 5, we provide robustness results. For this purpose, we only report estimates on $log\ COEC_{jt}$. While Table 4 focuses on alternative estimation methods, we do not change the basic specification and include the same control variables as before. Column (I) provides OLS estimates based on all observations and excluding the lagged dependent variables (standard errors are clustered at the country level). The estimated coefficient is close to the one obtained from the simple regression mentioned above (based on almost 44 million observations). We may interpret this effect as the long-run effect of $log\ COEC_{jt}$. In column (II), we estimate a fractional response model, following the approach in an earlier version of the paper (see Fahn et al., 2017). The reported estimate of -0.038 (std.err.: 0.001) refers to the average partial effect, which is comparable to the OLS estimate. Of course, while the non-linear model accounts for the bounded nature of the dependent variable, it also makes strong distributional assumptions. An interesting fact about the effect of -0.038 is that this corresponds precisely to the long-run effect of the dynamic model in column (III), Table 2. The estimate in column (III) is based on the Arellano-Bond

[18]This is consistent with the findings below, where we estimate non-dynamic OLS and fractional response models.

Table 4: Alternative Estimation Methods

	(I)	(II)	(III)	(IV)
$log\ COEC_{jt}$	-0.024**	-0.038***	-0.008***	-0.036***
	(0.010)	(0.001)	(0.001)	(0.010)
Firm and country controls	YES	YES	YES	YES
Time effects	YES	YES	YES	YES
Firm-entity effects	YES	YES	YES	YES
Observations	10,565,507	7,688,177	4,034,253	167,503

Notes: The table presents coefficients based on alternative estimation methods. Column (I) provides OLS estimates based on all observations and excluding the lagged dependent variables (std. err. clustered at the country level). In column (II), we estimate a fractional response model following the approach in an earlier version of the paper (see Fahn et al., 2017). The reported estimate of -0.038 refers to the average partial effect. Estimates in column (III) are based on the Arellano-Bond difference GMM estimator using all available instruments (see Arellano and Bond, 1991). Column (IV) reports estimates on $log\ COEC_{jt}$ using the *MiDi* dataset, which we utilized in an earlier version of the paper (see Fahn et al., 2017) (note that *MiDi* only includes German multinational corporations). The estimate also refers to the average partial effect obtained from a fractional response model. The dependent variable always refers to the debt-to-asset ratio, DR_{it}, of firm-entity i at time t. Robust and clustered (by country) standard errors reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

difference GMM estimator using all available instruments (see Arellano and Bond, 1991). The estimate is, as expected, almost identical to the one reported above using the Anderson-Hsiao approach. Column (IV) reports the finding on $log\ COEC_{jt}$ using the *MiDi* dataset, which we utilized in an earlier version of the paper (see Fahn et al., 2017) (note that *MiDi* only includes German multinational corporations and the number of observations is substantially lower). The estimate also refers to the average partial effect obtained from a fractional response model. Hence, comparing estimates in columns (II) and (IV), we can confirm quantitatively almost identical effects, even though the underlying dataset is a different one.[19]

Table 5 presents results using alternative clustering in columns (I) and (II). This

[19]The estimated standard error is much smaller in column (II), which is not very surprising, given that the number of observations underlying that particular estimate is 46 times larger.

tends to make estimates statistically more significant, as expected. In column (III), we include multinational corporations, which we have excluded before. Note that the Orbis dataset includes a large number of purely domestic firms, which we believe to more adequately reflect the mechanisms of our model. The reason is that estimates are not confounded by intrafirm trade and other issues specific to multinationals. Besides, we can be sure that the debt variable (our dependent variable) corresponds to debt raised from external creditors and does not include internal cross-border borrowing within multinationals (for which case the ability to and consequences of a default might be different). Including multinational firm does not however affect the results.

The idea of restricting the sample to observations after the year 2010 in column (IV) is to avoid confounding effects of the 2007/2008 global financial crisis. In column (V), finally, we balance our sample and make sure that all firm-entities are part of the estimation sample in all years. Both these tests hardly change the estimates on $log\ COEC_{jt}$, but naturally reduce the number of observations. Taken together, all findings in Tables 4 and 5 are highly consistent with the results in 2.

5.2. Risk

Including the firm-entity fixed effects should in principle control for risk. To test prediction 2 (the negative effect of risk on debt is less pronounced for higher costs of enforcing formal contracts), we interact the $COEC$ variable with alternative measures of risk. For this, we first calculate the standard deviation of firms' sales over time. We then calculate the median (mean) across all firms in a country j and sector s. The idea is to measure whether the typical firm in a country and sector faces highly volatile cash flows. After taking logs, we denote our risk measures by $Risk^a_{js}$ (for the median) and $Risk^b_{js}$ (for the mean). We then interact it with our $COEC$ variable.

The results are provided in Table 6. As expected, the interaction terms on $log\ COEC_{jt} \times Risk^a_{js}$ and $log\ COEC_{jt} \times Risk^b_{js}$ are associated with higher debt ratios, while the average impact of $COEC_{jt}$ remains negative and statistically significant.[20]

The relationship between a firm's bankruptcy risk and the discount factor in our model is probably nonlinear. In a low-risk environment, a slight increase in risk is arguably less likely to affect the probability of a bankruptcy than in a high-risk environment. To highlight this aspect, we finally define an indicator variable to distinguish very high-risk observations from other observations in our sample. To be

[20]The median risk measure, i.e. $Risk^a_{js}$, seems indeed more adequate in this context.

Table 5: Alternative Clustering and Samples

	(I)	(II)	(III)	(IV)	(V)
$log\ COEC_{jt}$	-0.009***	-0.009***	-0.009**	-0.009**	-0.008**
	(0.001)	(0.001)	(0.004)	(0.004)	(0.003)
Firm and country controls	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES
Firm-entity effects	YES	YES	YES	YES	YES
Observations	4,034,253	4,034,253	5,596,685	3,869,055	3,330,417

Notes: The table presents coefficients based on alternative clustering and samples. In column (I), we cluster at the level of firm groups. In column (II), we cluster at the level of firm-entity i. In column (III), we include multinational corporations, which we exclude in our basic sample. In column (IV), we drop all observations before 2010 to avoid confounding effects of the 2007/2008 global financial crisis. In column (V), we focus on a balanced panel. The dependent variable always refers to the debt-to-asset ratio, DR_{it}, of firm-entity i at time t. Robust and clustered (by country) standard errors reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table 6: Risk and COEC-responsiveness

	(I)	(II)	(III)
$log\ COEC_{jt}$	-0.009**	-0.009**	-0.009**
	(0.004)	(0.004)	(0.004)
$log\ COEC_{jt} \times Risk^a_{js}$	0.002**		
	(0.001)		
$log\ COEC_{jt} \times Risk^b_{js}$		0.001	
		(0.001)	
$log\ COEC_{jt} \times HIGHEST_{js}$			0.003***
			(0.001)
Time effects	YES	YES	YES
Firm-entity effects	YES	YES	YES
Firm- and country controls	YES	YES	YES
Observations	4,034,253	4,034,253	4,034,253

Notes: The table presents estimates with different interactions between *COEC* and measures of *Risk*. The dependent variable always refers to the debt-to-asset ratio, DR_{it}, of firm-entity i at time t. Robust and clustered (by country) standard errors reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

precise, we first define the binary variable $HIGHEST_{js}$. This indicator is one if the interaction between $log\ COEC_{jt} \times Risk^a_{js}$ is in the 1%-highest percentile of the distribution. We then interact $HIGHEST_{js}$ again with $log\ COEC_{jt}$, which allows us to nicely interpret the two coefficients on $log\ COEC_{jt}$ and $log\ COEC_{jt} \times HIGHEST_{js}$ together: while $log\ COEC_{jt}$ still has a negative effect on those operating in high-risk environments, it becomes smaller (less negative) by about a third.

6. Conclusions

This paper has demonstrated that institutions, in particular the costs associated with enforcing formal contracts, matter for firms' financing decisions. Our empirical analysis is guided by a theoretical approach that predicts a positive link between good contracting institutions and debt financing.

In our empirical analysis, based on a large panel dataset and a large number of firm-entity-year observations, we show that there is a robust negative relationship between the cost of enforcing a contract variable and the debt ratio. We run dynamic panel regressions, include many firm- as well as country-level controls, and provide numerous robustness tests. Our empirical estimates are highly consistent across alternative cost-of-enforcing-contract measures, alternative specifications, alternative data, and alternative estimation methods.

Quantitatively, our estimates suggest a long-run effect of about -0.038. Thus, a one-standard-deviation increase (0.32) in the formal cost to enforce a contract measure leads to a decrease of the debt-to-total asset ratio of about 1.2 percentage points ($-0.038 \times 0.32 = 0.0122$). We observe a number of institutional reforms in our data producing variation in the enforcement cost of similar magnitude. Our findings provide evidence on how institutional reform may affect a firm's capital structure.

References

[1] Abreu, D. (1988), "On the theory of infinitely repeated games with discounting," *Econometrica*, 56, 383-396.

[2] Acemoglu, D., S. Johnson and J.A. Robinson (2005), "Institutions as the fundamental cause of long-run growth," In: Aghion, P., S. Durlauf (Eds.), *Handbook of Economic Growth*, vol. 1A. North-Holland, London, 386-464.

[3] Ahammer, A., Fahn, M., and F. Stiftinger (2023), "Outside Options and Worker Motivation," Working Paper.

[4] Aggarwal, R. and N.A. Kyaw (2008), "Internal capital networks as a source of MNC competitive advantage: Evidence from foreign subsidiary capital structure decisions," *Research in International Business and Finance*, 22, 409-439.

[5] Anderson, T.W., and C. Hsiao (1982), "Formulation and estimation of dynamic models using panel data," *Journal of Econometrics*, 18, 47-82.

[6] Arellano, M., and S. Bond (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations," *Review of Economic Studies* 58, 277-97.

[7] Baker, G., R. Gibbons, and K.J. Murphy (1994), "Subjective performance measures in optimal incentive contracts," *Quarterly Journal of Economics*, 109, 1125-1156.

[8] Baker, S., and A.H. Choi (2016), "Embedding costly litigation into repeat interactions," working paper.

[9] Bakos, Y., and C. Dellarocas (2011), "Cooperation without enforcement? A comparative analysis of litigation and online reputation as quality assurance mechanisms," *Management Science*, 57, 1944-1962.

[10] Barron, D., J. Li, and M. Zator (2022) "Morale and Debt Dynamics," *Management Science*, 68, 4496-4516.

[11] Battigalli, P., and Giovanni Maggi (2008), "Costly contracting in a long-term relationship," *RAND Journal of Economics*, 39(2), 352-377.

[12] Berk, J. B., R. Stanton, and J. Zechner (2010), "Human capital, bankruptcy, and capital structure," *The Journal of Finance*, 65(3), 891-926.

[13] Besley, T. (2015), "Law, regulation, and the business climate: The nature and influence of the World Bank Doing Business project," *Journal of Economic Perspectives*, 29(3), 99-120.

[14] Buettner, T., M. Overesch, U. Schreiber, and G. Wamser (2009), "Taxation and capital structure choice-evidence from a panel of German multinationals," *Economics Letters,* 105(3), 309-311.

[15] Boehm, (2013), "The Impact of Contract Enforcement Costs on Outsourcing and Aggregate Productivity", unpublished manuscript.

[16] Chamberlain, G. (1980), "Panel data," *Handbook of Econometrics*, 2, 1247-1318.

[17] DeAngelo, H., and R.W. Masulis, (1980), "Optimal capital structure under corporate and personal taxation," *Journal of Financial Economics*, 8(1), 3-29.

[18] Desai, M.A., C.F. Foley, and J.R. Hines (2004), "A multinational perspective on capital structure choice and internal capital markets," *The Journal of Finance*, 59(6), 2451-2487.

[19] Desai, M.A., C.F. Foley, and J.R. Hines (2008), "Capital structure with risky foreign investment," *Journal of Financial Economics*, 88(3), 534-553.

[20] Djankov, S., R. LaPorta, F. Lopez-De-Silanes, and A. Shleifer (2003), "Courts," *Quarterly Journal of Economics*, 118(2), 453-517.

[21] Djankov, S., C. McLiesh, and A. Shleifer (2007), "Private credit in 129 countries," *Journal of Financial Economics*, 84(2), 299-329.

[22] Fahn, M., V. Merlo, and G. Wamser (2017), "Relational contracts, the cost of enforcing formal contracts, and capital structure choice – Theory and evidence," CESifo Working Paper No. 6562.

[23] Fahn, M., V. Merlo, and G. Wamser (2019), "The Commitment Role of Equity Financing," *Journal of the European Economic Association*, 17(4), 1-29.

[24] Farnsworth, K. (2004), *Corporate power and social policy in a global economy: British welfare under the influence,* MIT Press.

[25] Frank, M.Z., and V.K. Goyal (2009), "Capital structure decisions: which factors are reliably important?" *Financial Management*, 38(1), 1-37.

[26] Ganuza, J.J., F. Gomez, and M. Robles (2016), "Product liability versus reputation," *Journal of Law, Economics, and Organization,* 32(2), 213-241.

[27] Gennaioli, N., and G. Ponzetto (2017), "Optimally Vague Contracts and the Law," unpublished manuscript.

[28] Gibbons, R., and R. Henderson (2013), "What do managers do? Exploring persistent performance differences among seemingly similar enterprises," in R. Gibbons and John Robert (Eds.), *The Handbook of Organizational Economics,* Princeton University Press, 680-731.

[29] Goldbach, S., J. Møen, D. Schindler, G. Schjelderup, and G. Wamser (2021), "The tax-efficient use of debt in multinational corporations," *Journal of Corporate Finance*, 71, 102119.

[30] Graham, J.R. (2000), "How big are the tax benefits of debt?" *Journal of Finance,* 55, 1901-1941.

[31] Graham, J.R., and C.R. Harvey (2001), "The theory and practice of corporate finance: Evidence from the field" *Journal of Financial Economics,* 60(2), 187-243.

[32] Graham, J.R., and M.T. Leary (2011), "A review of empirical capital structure research and directions for the future," *Annual Review of Financial Economics*, 3, 309-345.

[33] Harris, M., and A. Raviv (1991), "The theory of capital structure," *Journal of Finance*, 46, 297-355.

[34] Huizinga, H., L. Laeven, and G. Nicodeme (2008), "Capital structure and international debt shifting," *Journal of Financial Economics,* 88(1), 80-118.

[35] Kesternich, I., and M. Schnitzer (2010), "Who is afraid of political risk? Multinational firms and their choice of capital structure," *Journal of International Economics*, 82(2), 208-218.

[36] Kreps, D.M., and R. Wilson (1982), "Sequential equilibria," *Econometrica*, 50(4), 863-894.

[37] La Porta, R., F. Lopez-de-Silanes, and A. Shleifer (2008), "The economic consequences of legal origins," *Journal of Economic Literature* 46(2), 285-332.

[38] Levine, R. (2005), "Finance and growth: Theory and evidence," in: Aghion, P., Durlauf, S.N. (Eds.), Handbook of Economic Growth Volume 1A. Elsevier, Amsterdam, pp. 865-934.

[39] Levine, R., Zervos, S. (1998), "Stock markets, banks, and economic growth," *American Economic Review* 88, 537-558.

[40] Maksimovic, V., and S. Titman (1991), "Financial policy and reputation for product quality," *Review of Financial Studies*, 4, 175-200.

[41] Malcomson, J. (2013), "Relational incentive contracts," in R. Gibbons and John Robert (edts.), *The Handbook of Organizational Economics*, Princeton University Press, 1014-1065.

[42] Martimort, D., A. Semenov, and L. Stole (2016), "A theory of contracts with limited enforcement," *Review of Economic Studies*, forthcoming.

[43] Mc Auliffe, S., G. Thunecke, and G. Wamser (2022), "The tax-elasticity of tangible fixed assets: Evidence from novel corporate tax data," RSIT Working Paper 11/2022.

[44] Myers, S.C. (1977), "Determinants of corporate borrowing," *Journal of Financial Economics*, 5, 147-175.

[45] Myers, S.C. (2001), "Capital structure," *The Journal of Economic Perspectives*, 15(2), 81-102.

[46] Nunn, N. (2007), "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade," *Quarterly Journal of Economics*, 122(2), 569-600.

[47] Nunn, N., and D. Trefler (2014), "Domestic institutions as a source of comparative advantage," *Handbook of International Economics*, 4, 263-315.

[48] Papke, L.E., and J.M. Wooldridge (2008), "Panel data methods for fractional response variables with an application to test pass rates," *Journal of Econometrics*, 145(1), 121-133.

[49] Posner, R.A. (2007), *Economic analysis of law*, Aspen.

[50] Rajan, R.G., and L. Zingales (1995), "What do we know about capital structure? Some evidence from international data," *The Journal of Finance*, 50(5), 1421-1460.

[51] Shleifer, A., and D. Wolfenzon (2002), "Investor protection and equity markets", *Journal of Financial Economics*, 66(1), 3-27.

[52] Strebulaev, I.A., and B. Yang (2013), "The mystery of zero-leverage firms," *Journal of Financial Economics*, 109(1), 1-23.

[53] Titman, S. (1984), "The effect of capital structure on a firm's liquidation decision," *Journal of Financial Economics*, 13, 137-151.

[54] Wamser, G., V. Merlo, M. Ruf, F. Stähler, K. Strohmaier, J. Eklund, J. Hansen, S. Laudage, S. Mc Auliffe, J. Paraknewitz, and G.U. Thunecke (2023). "A new database on international tax institutions". Forthcoming in RSIT Working Papers.

7. Appendix I – Additional tables

Table 7: Including level variables

	(I)	(II)	(III)
$SCORE_{jt}$	0.0003**		
	(0.0001)		
$COEC_{jt}$		-0.00028*	
		(0.00017)	
$TIME_{jt}$			-0.000003
			(0.0000008)
Time effects	YES	YES	YES
Firm-entity effects	YES	YES	YES
Firm- and country controls	YES	YES	YES

Notes: The table presents estimates based on our base-line sample of 4,034,253 observations. The dependent variable always refers to the debt-to-asset ratio, DR_{it}, of firm-entity i at time t. Robust and clustered (by country) standard errors reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table 8: *Changes in enforcing costs*

Year	ISO3 Code	Country	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2005	GBR	UK	30,8	35,8			**In 2003:** Update of the threshold and ceilings for courts (EC 2012, p.4 Table 59)	- Change in Claim Threshold (2003)	
2006	BLR	Belarus	17,4	23,4			**In 2004:** Streamline appeals (DB 2006 p. 62, Table 10.2)	- Streamline appeals (2004)	
2006	CZE	Czech Republic			34,3	33,8	**In 2004:** Streamline appeals (DB 2006 p. 62, Table 10.2)	- Streamline appeals (2004)	
2006	DNK	Denmark			24,6	23,3			
2006	LVA	Latvia			16,7	16,0	**In 2003:** Introduction of specialized public agencies and private bailiffs (DB 2005, p. 60)	- Introduction of Specialized Courts (2003)	- Introduction of Private Bailiffs (2003)
2006	RWA	Rwanda			85,0	78,7	**In 2005:** Introduction/Expansion of the scope of specialized courts (DB 2012, Table 6) **In 2004:** streamline appeals (DB 2006 p. 62, Table 10.2)	- Introduction/Expansion of the scope of specialized courts (2005)	- Streamline appeals (2004)
2006	SRB	Serbia			33,4	28,4	**In 2003:** Taking transactions out of the judges' hands(DB 2005, p. 63 Table 8.2) **In 2004:** streamline appeals, Setting time limits on judgements(DB 2006 p. 62, Table 10.2)	- Streamline appeals (2004)	- Time Limits (2004) - Taking transactions out of the judges' hands (2003)
2006	SVN	Slovenia			19,7	18,6	**In 2003:** Establishment of judicial statistic system and Taking transactions out of the judges' hands (DB 2005, p. 63 Table 8.2)	- Introduction of Performance Measurement (2003) - Taking transactions out of the judges' hands (2003)	
2006	GBR	UK	34,0	38,0					
2007	GEO	Georgia			41,2	29,9	**In 2005:** Introduction/Expansion of the scope of specialized courts (DB 2012,p.5 Table 6)	- Introduction/Expansion of the scope of specialized courts (2005)	
2007	PHL	Philippines	24,8	26,0					
2007	GBR	UK	39,8	41,7					
2007	UKR	Ukraine	41,5	43,8					
2008	MKD	Macedonia			33,1	28,8	**In 2008:** Introduction/Expansion of the scope of specialized courts (DB 2012, p.5 Table 6)	- Introduction/Expansion of the scope of specialized courts (2008)	
2008	GBR	UK	41,7	41,7					
2008	USA	USA	14,4	18,4					
2009	AUT	Austria	15,1	20,4			**In 2008:** Making electronic filing mandatory in civil matters (DB 2009, p. 51)	- Introduction of Case Management System: Mandatory E-Filing (2008)	
2009	ISL	Iceland	7,7	7,8					
2009	MOZ	Mozambique			53,3	53,3	**In 2009:** Improvements in the contract enforcement system by adding more judges with formal treatment; introducing court administrators to ease the administrative burden on judges; and introducing performance measurement for judges. **In 2008:** Improving commercial dispute resolution by hiring specialized judges and tightening the time limits on enforcement procedures.	- Hiring additional judges (2009) - Taking transactions [here: administrative duties] out of the judges' hands (2009) - Introduction of Performance Measurement (2009)	- Hiring specialized judges (2008) - Stricter time limits (2008)
2009	SRB	Serbia	28,4	28,9					
2009	SGP	Singapore	17,8	25,8					
2009	CHE	Switzerland	21,2	24,0					
2010	BWA	Botswana			39,8	39,8	**In 2010:** Making the resolution of commercial disputes more efficient by introducing case management and improving the use of information technology.	- Introduction of Case Management System including E-Filing (2010)	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2010	EST	Estonia	16,9	22,3					
2010	IRQ	Iraq	32,5	27,3					
2010	KEN	Kenya	28,8	41,8			**In 2010:** Introduction of seperate procdural rules for small, simple and complex claims (DB 2012, p.5)	- Introduction of Specialized Courts (2010)	
2010	LVA	Latvia	16,0	23,1					
2010	LUX	Luxembourg	8,8	9,7					
2010	MDA	Moldova	16,6	20,9			**In 2008:** Updating its civil procedure law to make it compliant with international standards and taking measures to reduce judicial corruption. **In 2010:** Introduction of private Bailiffs (DB 2012, p. 3, Table 3)	- Introduction of private Bailiffs (2010)	- Update in civil procedure law (2008)
2010	NZL	New Zealand	22,0	22,4					
2010	PRT	Portugal			17.6	16,4	**In 2010:** Allowing electronic filing for the initiation of a suit and reducing the need for intervention by the judge in the enforcement of a judgment. (more reforms in the past, see Portugal 2009 and 2005)	- Introduction of E-Filing for the initiation of a suit - Taking transactions out of the judges' hands (2010)	- More reforms, see 2009 and 2005
2010	ROU	Romania	16,8	25,8			See 2009		
2010	SVK	Slovak Republic	26,3	30,0					
2010	SVN	Slovenia	18,6	12,7					
2010	SWE	Sweden			31,3	31,2	**In 2010:** New legislation introducing more stringent timelines for civil cases. Improving the process by reinforcing the role of the judge in actively managing cases, amending evidence rules, requiring permission to appeal courts' decisions and reviewing statutory fees for enforcing judgments.	- Stricter Time Limits (2010) - Reinforcing the role of the judge in actively managing case (2010) - New evidence rules (2010) - Sticker rules for appeals (2010) - Reviewing statutory fees for enforcing judgments (2010)	
2010	VNM	Vietnam			31,0	28,5			
2011	ALB	Albania			38,7	35,7			
2011	BWA	Botswana			39,8	39,8	See 2010		
2011	ISL	Iceland	7,8	9,0					
2011	IRQ	Iraq	27,3	28,1					
2011	MWI	Malawi			142,4	94,1	**In 2011:** Raising the ceiling for commercial claims that can be brought to the magistrates court	- Change in claim threshold (2011)	
2011	SYC	Seychelles	14,3	15,4					
2011	TUR	Turkey	27,3	27,9			**In 2011:** Changing the procedural rules applying to commercial cases (EC 2013, p. 92, Table 17.3)	- Change in procedural rules (2011)	
2011	ZWE	Zimbabwe	32,0	113,1					
2012	AUS	Australia	22,1	23,2					
2012	MDA	Moldova	20,9	28,6			**In 2012:** Introduction of private bailiffs.	- Introduction of private bailiffs (2012)	
2012	NLD	Netherlands			24,4	23,9			
2012	SRB	Serbia	28,9	31,3			**In 2011/12:** Introduction of private bailiffs (DB 2013, Table 17.3)	- Introduction of private bailiffs (2011/12)	
2012	GBR	UK			41,7	41,7	**In 2011:** Modernizing civil procedures in the commercial court.	- Change in the civil procedure code (2011)	
2013	BEN	Benin					**In 2013:** Introducing a new code of civil, administrative and social procedures.	- New rules of civil porocedures	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2013	BRA	Brazil	16,5	20,7			**In 2013:** Introducing a new code of civil, administrative and social procedures.	- Electronic system for filling complaints	
2013	CMR	Cameroon					**In 2013:** Creating specialized commercial divisions within its courts of first instance.	- Specialized commercial divisions	
2013	GEO	Georgia					**In 2013:** Simplifying and speeding up the proceedings for commercial disputes.	- Changes of proceedings for commercial disputes	
2013	LBR	Liberia					**In 2013:** Creating a specialized commercial court.	- Specialized commercial court	
2013	MDA	Moldova					**In 2013:** Made the process of enforcing a contract more difficult by abolishing the specialized economic court.	- Abolishing the specialized economic court	
2013	POL	Poland	19	19,4			**In 2013:** Amending the civil procedure code and appointing more judges to commercial courts.	- Amending civil procedure code and more judges for commercial courts	
2013	RWA	Rwanda			78,7	65,3	**In 2013:** Implementing an electronic filing system for initial complaints.	- Electronic filing system	
2013	SAU	Saudi Arabia					**In 2013:** Expanding the computerization of its courts and introducing an electronic filing system.	- Electronic filing system	
2013	SRB	Serbia	31,3	34			**In 2013:** Introducing a private bailiff system.	- Private bailiff system	
2013	SVK	Slovak Republic					**In 2013:** Adopting several amendments to the code of civil procedure intended to simplify and speed up proceedings as well as to limit obstructive tactics by the parties to a case.	- Changes in code of civil procedure	
2013	TUR	Turkey			27,9	24,9	**In 2013:** Introducing a new civil procedure law.	- New civil procedure law	
2014	CHN	China					**In 2014:** Amending its civil procedure code to streamline and speed up all court proceedings.	- Amending civil procedure code	
2014	COL	Colombia			47,9	45,8	**In 2014:** Simplifying and speeding up the proceedings for commercial disputes.	- Changes for commercial disputes	
2014	CIV	Cote d'Ivoire					**In 2014:** Creating a specialized commercial court.	- Specialized commercial court	
2014	EST	Estonia			22,3	21,9	**In 2014:** Lowering court fees.	- Lower court fees	
2014	HRV	Croatia					**In 2014:** Streamlining litigation proceedings and transferring certain enforcement procedures from the courts to state agencies.	- Streamlining litigation proceedings and transferring enforcement procedures from the courts to state agencies	
2014	ITA	Italy			30,4	23,6	**In 2014:** Regulating attorneys' fees and streamlining some court proceedings.	- Regulating attorneys' fees and streamlining some court proceedings	
2014	MUS	Mauritius	16,3	25			**In 2014:** Liberalizing the profession of court ushers, including by allowing registered ushers to serve as bailiffs in carrying out enforcement proceedings.	- Liberalizing the profession of court ushers	
2014	MEX	Mexico					**In 2014:** Creating small claims courts, with oral proceedings, that can hear both civil and commercial cases.	- Setting up small claims courts	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2014	NZL	New Zealand					**In 2014:** Improving its case management system to ensure a speedier and less costly adjudication of cases.	- Improving case management system	
2014	PLW	Palau					**In 2014:** Introducing an electronic filing system for court users.	- Electronic filing system	
2014	ROU	Romania					**In 2014:** Adopting a new civil procedure code that streamlines and speeds up all court proceedings.	- New civil procedure code	
2014	TGO	Togo					**In 2014:** Creating specialized commercial divisions within the court of first instance.	- Specialized commercial divisions	
2014	UZB	Uzbekistan					**In 2014:** Introducing an electronic filing system for court users.	- Electronic filing system	
2014	BHS	Bahamas					**In 2014:** Introducing new rules of civil procedure focused on streamlining and simplifying court proceedings and ensuring less costly resolution of disputes.	- New rules of civil porocedures	
2015	BHS	Bahamas					**In 2015:** Introducing new rules of civil procedure focused on streamlining and simplifying court proceedings and ensuring less costly resolution of disputes.	- New rules of civil porocedures	
2015	BEN	Benin					**In 2015:** Creating a commercial section within its court of first instance.	- Commercial section within its court of first instance	
2015	CZE	Czech Republic					**In 2015:** Amending its civil procedure code and modifying the monetary jurisdictions of its courts.	- Amending civil procedure code	
2015	GRC	Greece					**In 2015:** Introducing an electronic filing system for court users.	- Electronic filing system	
2015	IRL	Ireland					**In 2015:** Modifying the monetary jurisdictions of its courts.	- Modifying the monetary jurisdictions	
2015	KAZ	Kazakhstan					**In 2015:** Introducing an electronic filing system for court users.	- Electronic filing system	
2015	LTU	Lithuania					**In 2015:** Introducing an electronic filing system for court users.	- Electronic filing system	
2015	MUS	Mauritius					**In 2015:** Introducing an electronic filing system for court users.	- Electronic filing system	
2015	PRT	Portugal	16,4	17,2			**In 2015:** Adopting a new code of civil procedure designed to reduce case backlogs, streamline court procedures, enhance the role of judges and speed up the resolution of standard civil and commercial disputes.	- New civil procedure code	
2015	SYC	Seychelles					**In 2015:** Establishing a commercial court, implementing and refining its case management system, introducing court-annexed mediation, and addressing scheduling conflicts within the courts.	- Establishing commercial court, new case managementr system and new mediation law	
2015	SGP	Singapore					**In 2015:** Introducing a new electronic litigation system that streamlines litigation proceedings.	- Electronic litigation system	
2015	ZAF	South Africa					**In 2015:** Amending the monetary jurisdiction of its lower courts and introducing voluntary mediation.	- Amending monetary jurisdiction and voluntary mediation	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2015	TUR	Turkey					**In 2015:** Introducing an electronic filing system for court users.	- Electronic filing system	
2015	URY	Uruguay					**In 2015:** Simplifying and speeding up the proceedings for commercial disputes.	- Simplifying and speeding up the proceedings for commercial disputes	
2015	XXK	Kosovo	33	34,4			**In 2015:** Introducing a private bailiff system.	- Private bailiff system	
2016	ARE	United Arab Emirates	20,4	21			**In 2016:** Implementing electronic service of process, by introducing a new case management office within the competent court and by further developing the "Smart Petitions" service allowing litigants to file and track motions online.	- Electronic service of process, new case management office and service allowing litigants to file and track motions online	
2016	ARM	Armenia					**In 2016:** New law requiring that cases be assigned to judges randomly and through a fully automated system in courts throughout the country.	- Cases assigned randomly	
2016	CIV	Côte d'Ivoire					**In 2016:** Introducing new provisions on voluntary mediation.	- New provisions on mediation law	
2016	CYP	Cyprus					**In 2016:** Introducing a fast-track simplified procedure for claims worth less than 3,000 Euro.	- Fast-track procedure for small claims	
2016	GBR	United Kingdom	41,7	45,7			**In 2016:** Made enforcing contracts more costly by increasing the court fees for filing a claim.	- Increasing court fees	
2016	GEO	Georgia					**In 2016:** Introducing an electronic filing system for court users.	- Electronic filing system	
2016	HRV	Croatia					**In 2016:** Introducing an electronic system to handle public sales of movable assets and by streamlining the enforcement process as a whole.	- E-system to handle public sales of movable assets	
2016	ITA	Italy	23,6	27,6			**In 2016:** Introducing a mandatory electronic filing system for court users, simplifying the rules for electronic service of process and automating the enforcement process.	- Mandatory electronic filing system	
2016	KAZ	Kazakhstan					**In 2016:** Introducing a simplified fast-track procedure for small claims and by streamlining the rules for enforcement proceedings.	- Fast-track procedure for small claims	
2016	LVA	Latvia					**In 2016:** Restructuring its courts and by introducing comprehensive specialized laws regulating domestic arbitration and voluntary mediation.	- Restructuring courts and introducing comprehensive specialized laws	
2016	ROU	Romania					**In 2016:** Transferring some enforcement responsibilities from the court to the bailiff, by making it easier for the bailiff to obtain information from third parties and by making use of the electronic auction registry mandatory.	- Transferring some enforcement responsibilities from court to bailiff	
2016	SEN	Senegal					**In 2016:** Introducing a law regulating voluntary mediation.	- New mediation law	
2017	ARM	Armenia					**In 2017:** Introducing a consolidated chapter regulating voluntary mediation and establishing financial incentives for the parties to attempt mediation.	- New mediation law	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2017	BOL	Bolivia					**In 2017:** Adopting a new code of civil procedure that introduces pre-trial conferences and by implementing an automated system to assign cases to judges randomly.	- New code of civil procedures and cases assigned randomly	
2017	BRA	Brazil	20,7	22			**In 2017:** New mediation law that includes financial incentives for parties to attempt mediation and a new code of civil procedure. These reforms apply to both Rio de Janeiro and São Paulo.	- New mediation law and new code of civil procedure	
2017	BRN	Brunei Darussalam					**In 2017:** Introducing an electronic filing system as well as a platform that allows users to pay court fees electronically.	- Electronic system for filling complaints and electronic payment	
2017	CHN	China					**In 2017:** Introducing an online platform that allows lawyers to manage cases electronically. This reform applies to Beijing.	- E-system to manage cases electronically	
2017	CIV	Côte d'Ivoire					**In 2017:** Introducing a simplified fast-track procedure for small claims that allows for parties' self-representation.	- Fast-track procedure for small claims	
2017	ECU	Ecuador					**In 2017:** Adopted a new code of civil procedure that made enforcing contracts easier by introducing a pre-trial conference. The new code also made enforcing contracts more difficult by eliminating a dedicated procedure for the resolution of small claims.	- New code of civil procedure	
2017	ESP	Spain					**In 2017:** Introducing a mandatory electronic filing system for court users.	- Mandatory electronic filing system	
2017	GRC	Greece					**In 2017:** Amending its rules of civil procedure to introduce tighter rules on adjournments, impose deadlines for key court events and limit the recourses that can be lodged during enforcement proceedings.	- Amending rules of civil procedure	
2017	HUN	Hungary					**In 2017:** Introducing an electronic filing system.	- Electronic filing system	
2017	IND	India					**In 2017:** Creating dedicated divisions to resolve commercial cases. This reform applies to both Mumbai and Delhi.	- Dedicated divisions to resolve commercial cases	
2017	IDN	Indonesia					**In 2017:** Introducing a dedicated procedure for small claims that allows for parties' self-representation. This reform applies to both Jakarta and Surabaya.	- Dedicated procedure for small claims	
2017	IRN	Iran	17	19,3			**In 2017:** Implementing electronic service of process.	- Electronic service of process	
2017	KAZ	Kazakhstan					**In 2017:** Adopting a new code of civil procedure and by regulating the maximum number of adjournments that can be granted by a judge in a given case.	- New code of civil procedure and regulating maximum number of adjournments	
2017	MDA	Moldova					**In 2017:** Adopting a new mediation law establishing financial incentives for the parties to attempt mediation.	- New mediation law	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2017	NER	Niger					**In 2017:** Creating a specialized commercial court in Niamey and by adopting a new code of civil procedure that establishes time standards for key court events.	- Specialized commercial court and new code of civil procedure	
2017	MKD	North Macedonia					**In 2017:** Made enforcing contracts more difficult by adopting amendments to the Law on civil procedure that mandate mediation before filing a claim, thus lengthening the initial phase of judicial proceedings.	- Adopting amendments to the Law on civil procedure that mandate mediation before filing a claim	
2017	NOR	Norway					**In 2017:** Introducing an electronic filing system for court users.	- Electronic filing system	
2017	RUS	Russian Federation					**In 2017:** Made enforcing contracts more difficult by mandating pre-trial resolution before filing a claim, thereby lengthening the initial phase of judicial proceedings. This reform applies to both Moscow and St. Petersburg.	- Mandating pre-trial resolution before filing a claim	
2017	RWA	Rwanda					**In 2017:** Introducing an electronic case management system for judges and lawyers.	- Electronic case management system	
2017	SYR	Syrian Arab Republic					**In 2017:** Adopting a new code of civil procedure.	- New code of civil procedure	
2017	UKR	Ukraine					**In 2017:** Introducing a system that allows users to pay court fees electronically.	- Paying court fees electronically	
2018	AGO	Angola					**In 2018:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2018	AZE	Azerbaijan					**In 2018:** Introducing a system that allows users to pay court fees electronically.	- Electronic payment of court fees	
2018	BHR	Bahrain					**In 2018:** Introducing an electronic case management system for the use of judges and lawyers.	- Electronic case management system	
2018	BTN	Bhutan					**In 2018:** Creating a dedicated bench to resolve commercial cases.	- Dedicated bench	
2018	BRN	Brunei Darussalam					**In 2018:** Introducing an electronic case management system for the use of judges and lawyers.	- Electronic case management system	
2018	ESP	Spain			18,5	17,2	**In 2018:** Reducing court fees for filing a claim.	- Reducing court fees	
2018	GUY	Guyana	25,2	27			**In 2018:** Adopting a new code of civil procedure regulating time standards for key court events.	- New code of civil procedure	
2018	HUN	Hungary					**In 2018:** Introducing a system that allows users to pay court fees electronically.	- Electronic payment of court fees	
2018	IND	India					**In 2018:** Introducing the National Judicial Data Grid, which makes it possible to generate case measurement reports on local courts. This reform applies to both Delhi and Mumbai.	- Publishing case measurement reports on local courts	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2018	IRL	Ireland					**In 2018:** Making performance measurement reports publicly available to show the court's performance and the progress of cases through the court.	- Publishing performance reports on courts	
2018	KAZ	Kazakhstan					**In 2018:** Introducing additional time standards for key court events that are respected in the majority of cases.	- Additional time standards for key court events	
2018	KWT	Kuwait					**In 2018:** Introducing an electronic case management system for the use of judges.	- Electronic case management system	
2018	LVA	Latvia					**In 2018:** Introducing an electronic case management system for the use of judges.	- Electronic case management system	
2018	MRT	Mauritania					**In 2018:** Making judgements rendered at all levels in commercial cases available to the general public on the courts' websites.	- Publishing all judgements in commercial cases	
2018	NAM	Namibia					**In 2018:** Introducing an electronic filing system and an electronic case management system for the use of judges and lawyers.	- Electronic filing system and electronic case management system	
2018	NZL	New Zealand					**In 2018:** Made enforcing contracts more difficult by suspending the filing of new commercial cases before the Commercial List of the High Court of New Zealand during the establishment of a new Commercial Panel.	- Suspending the filing of new commercial cases	
2018	NIC	Nicaragua					**In 2018:** Adopting a new code of civil procedure that introduces stricter case management rules.	- New code of civil procedure	
2018	NOR	Norway					**In 2018:** Introducing an online platform that implements electronic service of process and allows judges and lawyers to manage cases electronically.	- Electronic service of process and electronic case management system	
2018	OMN	Oman					**In 2018:** Introducing an electronic case management system for judges.	- Electronic case management system	
2018	RWA	Rwanda					**In 2018:** Making judgements rendered at all levels in commercial cases available to the general public through publication on the judiciary's website.	- Publishing all judgements in commercial cases	
2018	SAU	Saudi Arabia					**In 2018:** Introducing an electronic case management system for the use of judges and lawyers.	- Electronic case management system	
2018	SEN	Senegal					**In 2018:** Introducing stricter pre-trial hearing rules that led to a reduction of the time necessary to resolve a commercial dispute.	- Stricter pre-trial hearing rules	
2018	SRB	Serbia	34	39,6			**In 2018:** Adopting a new enforcement law that broadens and clarifies the responsibilities of enforcement agents as well as the powers of the courts during the enforcement process.	- New enforcement law	
2018	SVK	Slovak Republic			30,6	20,5	**In 2018:** Adopting a new code of civil procedure that introduces pre-trial conference as part of the case management techniques used in court. The Slovak Republic also made enforcing contracts easier by reducing the fees that are advanced by the plaintiff to enforce a judgment.	- New code of civil procedure and reduced fees	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2018	CHE	Switzerland					**In 2018:** Introducing an electronic filing system.	- Electronic filing system	
2018	TWN	Taiwan					**In 2018:** Introducing an electronic filing system.	- Electronic filing system	
2018	THA	Thailand					**In 2018:** Introducing a system that allows users to pay court fees electronically. Thailand also reduced enforcement times by increasing the automation and efficiency of enforcement processes.	- Paying court fees electronically and increased automation and efficiency of enforcement processes	
2018	TUR	Turkey					**In 2018:** Publishing performance measurement reports on local commercial courts.	- Publishing performance measurement reports	
2018	VNM	Vietnam					**In 2018:** Adopting a new code of civil procedure and by introducing a consolidated law on voluntary mediation.	- New code of civil procedure and voluntary mediation	
2019	ARM	Armenia					**In 2019:** Introducing a simplified procedure for small claims and time standards for key court events.	- Simplified procedures	
2019	BEN	Benin					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	BFA	Burkina Faso					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	CMR	Cameroon					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	CAN	Canada					**In 2019:** Introducing an e-system that allows plaintiffs to file the initial complaint and pay court fees electronically.	- E-system to file initial complaints and electronic payment of court fees	
2019	CAF	Central African Republic					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	TCD	Chad					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	CHL	Chile					**In 2019:** Introducing an e-system that allows plaintiffs to file the initial complaint electronically.	- E-system to file initial complaints and electronic payment of court fees	
2019	COM	Comoros					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	COD	Congo, Dem. Rep.					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	COG	Congo, Rep.					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	CIV	Côte d'Ivoire					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	DNK	Denmark					**In 2019:** Introducing an online platform that allows users to file the initial complaint electronically and judges and lawyers to manage cases electronically.	- E-system for initial complaints and case management	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2019	DJI	Djibouti					**In 2019:** Establishing a dedicated division within the court of first instance to resolve commercial cases and by adopting a new Code of Civil Procedure that regulates voluntary conciliation and mediation proceedings, as well as time standards for key court events.	- New code of civil procedure	
2019	CNQ	Equatorial Guinea					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	ETH	Ethiopia					**In 2019:** Establishing specialized benches to resolve commercial cases.	- Specialized benches for commercial cases	
2019	GAB	Gabon					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	GEO	Georgia					**In 2019:** Introducing random and automatic assignment of cases to judges throughout the courts.	- Cases assigned automatically and randomly	
2019	GIN	Guinea					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	GNB	Guinea-Bissau					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	IRL	Ireland					**In 2019:** Introducing a consolidated law on voluntary mediation.	- New mediation law	
2019	JOR	Jordan					**In 2019:** Introducing a system that allows users to pay court fees electronically.	- Electronic payment of court fees	
2019	KAZ	Kazakhstan					**In 2019:** Making judgments rendered at all levels in commercial cases publicly available and publishing performance measurement reports on local commercial courts.	- Publishing performance measurement reports on local commercial courts	
2019	KGZ	Kyrgyz Republic					**In 2019:** Introducing a pre-trial conference as part of the case management techniques in court and adopting a consolidated law on voluntary mediation.	- Pre-trial conference and new mediation law	
2019	MDG	Madagascar					**In 2019:** Introducing an automated system that randomly assigns cases to judges and that allows judges to manage cases electronically.	- Cases assigned randomly and electronic case management system	
2019	MWI	Malawi					**In 2019:** Adopting new civil procedure rules regulating time standards for key court events.	- New civil procedure rules	
2019	MLI	Mali					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	MNG	Mongolia			30,6	22,9	**In 2019:** Reducing the fees that are advanced by the plaintiff to enforce a judgment.	- Reducing fees	
2019	NER	Niger					**In 2019:** Introducing a simplified procedure for small claims, rules limiting adjournments and mediation as an alternative dispute resolution mechanism.	- Simplified procedure for small claims and new mediation rules	
2019	NGA	Nigeria					**In 2019:** Issuing new rules of civil procedure for small claims courts which limit adjournments to unforeseen and exceptional circumstances.	- New rules of civil procedure for small claims courts	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2019	POL	Poland					**In 2019:** Introducing an automated system to assign cases to judges randomly.	- Cases assigned automatically and randomly	
2019	PRI	Puerto Rico					**In 2019:** Introducing a web-based platform that offers lawyers a single access point for electronic filing of the initial complaint and for electronic payment of court fees. The system also allows lawyers and judges to manage case files throughout the litigation process.	- Single access point for electronic filing and paying court fees	
2019	RWA	Rwanda			65,3	64,6	**In 2019:** Issuing new rules of civil procedure which limit adjournments to unforeseen and exceptional circumstances and establish a simplified procedure for small claims.	- New rules of civil procedure to limit adjournments and simplified procedure for small claims	
2019	STP	São Tomé and Príncipe			50,5	45,6	**In 2019:** Adopting a new code of procedural costs that simplified and reduced court fees.	- Reduced court fees	
2019	SAU	Saudi Arabia					**In 2019:** Introducing an e-system that allows plaintiffs to file the initial complaint electronically and amending the civil procedure rules to introduce time standards for key court events.	- Electronic filing system and time standards for key court events	
2019	SEN	Senegal					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	SGP	Singapore					**In 2019:** Introducing a consolidated law on voluntary mediation.	- New mediation law	
2019	SVK	Slovak Republic					**In 2019:** Implementing electronic service of process.	- Electronic service of process	
2019	SVN	Slovenia					**In 2019:** Introducing a pre-trial conference as part of the case management techniques used in court.	- Introducing pre-trial conferences	
2019	LKA	Sri Lanka					**In 2019:** Introducing a pre-trial conference as part of the case management techniques used in court.	- Introducing pre-trial conferences	
2019	SDN	Sudan					**In 2019:** Recognizing voluntary conciliation and mediation as ways of resolving commercial disputes.	- Recognizing voluntary conciliation and mediation as ways of resolving commercial disputes	
2019	TGO	Togo					**In 2019:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2019	TUR	Turkey					**In 2019:** Publishing judgments rendered at all levels in commercial cases, and by introducing financial incentives for mediation.	- Publishing judgments and gives incentives for mediation	
2019	UKR	Ukraine					**In 2019:** Introducing a simplified procedure for small claims and pre-trial conferences as part of the case management techniques used in all commercial courts.	- Simplified procedure for small claims and pre-trial conferences	
2019	VNM	Vietnam					**In 2019:** Making judgments rendered at all levels in commercial cases available to the public online.	- Judgements available online	
2019	ZMB	Zambia					**In 2019:** Making judgments rendered in commercial matters at the appellate and supreme court levels available to the general public online.	- Judgements available online	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2019	ZWE	Zimbabwe					**In 2019:** Making judgments rendered at the appellate and supreme court level in commercial cases available to the general public online.	- Judgements available online	
2020	ARG	Argentina					**In 2020:** Allowing electronic payment of court fees.	- Electronic payment of court fees	
2020	AZE	Azerbaijan					**In 2020:** Introducing an e-system that allows plaintiffs to file the initial complaint electronically and by adopting a consolidated law on voluntary mediation.	- E-system for plaintiffs and new mediation law	
2020	BHR	Bahrain					**In 2020:** Creating a specialized commercial court, establishing time standards for key court events and allowing electronic service of the summons.	- Specialized commercial court and electronic services	
2020	BRB	Barbados					**In 2020:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	
2020	BRN	Brunei Darussalam					**In 2020:** Publishing performance measurement reports.	- Publishing performance measurement reports	
2020	CHN	China					**In 2020:** Regulating the maximum number of adjournments that can be granted and limiting adjournments to unforeseen and exceptional circumstances. This reform applies to both Beijing and Shanghai. China (Shanghai) made enforcing contracts easier by publishing court performance measurement and progress reports.	- Regulate adjournments and publishing court performance reports	
2020	CRI	Costa Rica					**In 2020:** Adopting a new code of civil procedure that introduced pretrial conferences as part of the case management techniques in court.	- New code of civil procedure	
2020	CIV	Côte d'Ivoire					**In 2020:** Publishing reports on commercial court performance and progress of cases.	- Publishing court performance reports	
2020	DOM	Dominican Republic					**In 2020:** Establishing specialized commercial court divisions and by adopting a framework for mediation and conciliation including in commercial cases.	- Specialized commercial court divisions and mediation framework	
2020	DEU	Germany					**In 2020:** Introducing electronic filing of the initial complaint and electronic service of process without the need for paper documents.	- Electronic filing system	
2020	IND	Indonesia					**In 2020:** Introducing an electronic case management system for judges. This reform applies to both Jakarta and Surabaya.	- Electronic case management system	
2020	JAM	Jamaica					**In 2020:** Introducing a judicial performance measurement mechanism that provides publicly available information on time to disposition and clearance rate.	- Publishing performance reports on courts	
2020	XXK	Kosovo					**In 2020:** Introducing a consolidated law on voluntary mediation.	- New mediation law	
2020	LBN	Lebanon					**In 2020:** Adopting a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- New mediation law	

Table 8: *Changes in enforcing costs, continued*

Year	ISO3 Code	Courty	EC costs increase from	EC costs increase to	EC costs decrease from	EC costs decrease to	Reasons	Summary	Reforms in earlier years
2020	MDG	Madagascar					**In 2020:** Publishing performance measurement and progress reports for the commercial court.	- Publishing performance measurement and progress reports	
2020	MRT	Mauritania					**In 2020:** Introducing a simplified procedure for small claims, setting time standards for key court events, and limiting adjournments. Mauritania also adopted a law that regulates all aspects of mediation as an alternative dispute resolution mechanism.	- Simplified procedure for small claims, setting time standards and new mediation law	
2020	MUS	Mauritius					**In 2020:** Publishing performance measurement reports for the commercial division of the Supreme Court.	- Publishing performance measurement reports	
2020	MDA	Moldova					**In 2020:** Amending the code of civil procedure to establish a simplified procedure for small claims.	- Amending the code of civil procedure	
2020	MNG	Morocco					**In 2020:** Introducing an automated system that randomly assigns cases to judges and by publishing court measurement performance reports.	- Cases assigned automatically and randomly and publishing performance measurement reports	
2020	MMR	Myanmar					**In 2020:** Publishing performance measurement reports.	- Publishing performance measurement reports	
2020	NPL	Nepal	26,8	27,3			**In 2020:** Adopting a new code of civil procedure that introduces time standards for key court events.	- New code of civil procedure	
2020	NGA	Nigeria					**In 2020:** Introducing a pre-trial conference as part of the case management techniques used in court. This reform applies to both Kano and Lagos. Nigeria (Kano) also made enforcing contracts easier by issuing new rules of civil procedure for small claims courts, which limit adjournments to unforeseen and exceptional circumstances.	- Introduce pre-trial conference	
2020	MKD	North Macedonia			30,4	2,6	**In 2020:** Simplifying the calculation of enforcement fees as well as making the overall process less costly.	- Reducing fees	
2020	PRY	Paraguay					**In 2020:** Introducing an electronic case management system for judges and lawyers.	- Electronic case management system	
2020	SAU	Saudi Arabia					**In 2020:** Publishing court performance measurement reports and information on the progress of cases through the court.	- Publishing court performance measurement reports	
2020	SRB	Serbia					**In 2020:** Establishing financial incentives for the parties to attempt mediation.	- New mediation law	
2020	ZAF	South Africa					**In 2020:** Introducing a specialized court dedicated to hearing commercial cases.	- Specialized court dedicated to hearing commercial cases	
2020	USA	United States					**In 2020:** Introducing electronic filing and electronic payment of court fees.	- Electronic filing and electronic payment of court fees	
2020	UZB	Uzbekistan					**In 2020:** Introducing a consolidated law on voluntary mediation, establishing financial incentives for the parties to attempt mediation and publishing performance measurement reports on local commercial courts.	- New mediation law and new code of civil procedure and publishing performance measurement reports	

8. Appendix II – Theoretical Analysis

Here, we introduce the formal that we have described above and used to derive our empirical predictions.

8.1. Model

8.1.1 Technology

There are two firms, a downstream party and an upstream party, the time horizon is infinite, time is discrete and players share a common discount factor $\delta < 1$. The downstream party needs two inputs to operate – a physical investment good and an intermediate good that can only be produced by the upstream party.

More precisely, the downstream party requires one unit of the intermediate good in every period $t = 1, 2, ...$ The quality of this good can either be high or low, $q_t \in \{0, 1\}$, and the upstream party has production costs $q_t c$, with $c > 0$. For the downstream party, the intermediate good has a value $q_t\theta$, with $\theta > 0$. Thus, only a high-quality intermediate good is of value to the downstream party and costly to produce for the upstream party. Upon receiving the intermediate good, the downstream party can generate the value $q_t\theta$ at zero marginal cost.

The physical investment good is purchased at the beginning of the game, in period $t = 0$. There, the downstream party has to invest an exogenously given amount $I > 0$ to get her business running.[21] To finance I, it can either use equity or short-term debt. We assume that the downstream party is not liquidity constrained and has sufficient internal funds to finance I with equity.

The investment good as well as the intermediate good have no outside value. Furthermore, there is no alternative supplier that can produce the specific intermediate good and no alternative intermediate good with positive value for the downstream party. These assumptions have no qualitative impacts on our results, as long as the relationship between upstream party and downstream party has a larger value than alternative opportunities.

Finally, we assume that $\frac{\delta}{1-\delta}(\theta - c) - I > 0$. This implies not only that producing high quality is efficient, but also that starting the downstream party's firm is efficient, as well as continuing it in every period.

[21] We assume that the upstream party does not need to make such an investment and abstract from the upstream party's financing decision. Below, in Section 8.7, we also let the upstream party make an up-front investment and show that this does not affect our results.

8.1.2 Credit Market

If the downstream party intends to use debt to (partially) finance the investment I, it can enter a perfectly competitive credit market at the end of every period $t = 0, 1, 2, ...$, where all potential creditors are risk neutral and have a discount factor δ. The amount of debt borrowed in period $t-1$ and used in period t is denoted by $D_t (\leq I)$, so that equity amounts to $I - D_t$. Interest is denoted by r_t and paid at the end of period t. Hence, the downstream party repays $(1 + r_t)D_t$ before it can enter the credit market in period $t + 1$ to borrow D_{t+1}.

We assume that given high quality has been produced, the downstream party always has sufficient funds to repay her debt. If the downstream party refuses to repay $(1 + r_t)D_t$ and instead defaults, its business is liquidated at the end of period t. The downstream party is protected by limited liability, so creditors do not receive any repayment given the downstream party defaults.[22]

8.1.3 Contractability

We first describe our assumptions on contractability, and discuss some of them below, in Section 8.4. In every period, the downstream party makes a contract offer to the upstream party. This contract involves an ex-ante payment w_t and a price P_t to be paid upon delivery, as well as the quality level q_t. w_t and P_t can assume negative values, indicating payment streams from upstream to downstream party. In the following, we focus on contracts that prescribe delivery of high quality. The parties can use formal spot contracts or relational contracts (or a combination of both) to enforce their agreement. The latter are self-enforcing implicit arrangements and further described below.

Formal enforcement is costly, and is carried out by a court which is able to determine the quality of the intermediate good and whether contractually specified payments have been made. Assume that the downstream party withholds payment of the price and claims that quality is low. If quality has actually been high, the upstream party can sue the downstream party, in which case it wins with probability 1 and is subsequently awarded P_t, but has to bear (net) enforcement cost $K > 0$. The litigation value enforced by a court cannot exceed θ, the value the intermediate good has for the downstream party. Hence, courts only enforce prices $P_t \leq \theta$.

Being sued and losing a trial is also costly for the downstream party. We do not have to specify the exact amount of the downstream party's cost when losing a trial,

[22]The possibility of creditors taking over after a default and continuing to run the downstream party's business would not affect our results, as long as the original downstream party fully loses access to its original business.

though, since those do not affect any player's optimal behavior. If the upstream party refuses to deliver high quality, we assume, without loss, that it just does not receive P_t.

The downstream party can keep the intermediate good in any case, even after refusing to pay the price P_t and *not* being sued by the upstream party afterwards.

Finally, creditors cannot detect the quality of the intermediate good and whether the downstream party agrees to pay P_t, but find out whenever the upstream party sues the downstream party and then observe the outcome of the verdict. To simplify the analysis, we assume that all aspects of the relationship between downstream party and creditors (not between downstream and upstream party) are detected by the whole credit market. This allows us to simplify on notation and assume without loss of generality that the principal only borrows from one creditor.

8.1.4 Equilibrium

The equilibrium concept we apply is subgame-perfect equilibrium. There, strategies maximize a player's discounted payoff stream, given other players' strategies. Note that we do not treat creditors as full players but assume they are willing to lend at conditions where they do not expect losses, taking equilibrium play as given. Without loss of generality, we confine our interest to stationary contracts which is particularly important for the relational contract. To understand why using stationary contracts is without loss, note that the downstream party could either use the payment P_t to compensate the upstream party for the provision of high quality in period t, or promise future rents. Given both players are risk neutral and there is no uncertainty, any equivalent substitution between current and future payment streams does not affect incentives and whether any of the constraints derived below is satisfied or not (see MacLeod and Malcomson, 1989, or Levin, 2003). For the debt level, we derive maximum amounts which still allow for high quality. Those will also be the same in every period.[23]

Hence, on the equilibrium path, quality q, payments w and P, and debt level D are the same in every period t. This allows us to omit time subscripts.

In the following, our objective is to characterize a stationary subgame-perfect equilibrium that maximizes the firm's expected discounted profit stream in period $t = 0$.

[23]If, however, the downstream had to finance the upfront investment with debt because of the unavailability of alternative funding opportunities, and if quality was a continuous variable, the optimal relational contract would not be stationary but involve a gradual repayment of debt to allow for higher quality later on (see Barron et al., 2022)

8.1.5 Payoffs

The downstream party's per-period payoff in an equilibrium where it pays the price P is $\pi = q \cdot \theta - w - P - (1 + r)D + D$. The upstream party's per-period payoff in this case amounts to $u = w + P - q \cdot c$. Both players are assumed to have outside options of zero, and the downstream party's discounted payoff stream in any period $t \geq 1$, given high quality is provided, equals

$$\Pi = \frac{\theta - w - P - rD}{1 - \delta}.$$

In period $t = 0$, when the investment I must be made, the downstream party's payoff stream is

$$\Pi_0 = -(I - D) + \delta\Pi.$$

Finally, the upstream party's discounted payoff stream in any period $t \geq 1$, given high quality is provided, equals

$$U = \frac{w + P - c}{1 - \delta}.$$

8.2. Arrangement Between Downstream and Upstream Party

The downstream party has two arrangements, one with the upstream party and (potentially) one with a creditor. In this section, we focus on the former and analyze the different forms of downstream-upstream relationships. We assume that on the equilibrium path, defaulting on debt is never optimal for the downstream party and derive the respective conditions for this to hold in the subsequent section.

The arrangement between downstream and upstream party determines payments w and P, and that the intermediate good ought to be of high quality in every period. The downstream party is supposed to pay P at the end of a period if quality is high, but still might be tempted to refuse payment. Therefore, it is crucial to identify if and how the payment P can actually be *enforced*. Potential mechanisms are formal, court-enforceable contracts, relational contracts, or a combination of those two.

Before exploring enforcement, note that in any case it must be optimal for the upstream party to enter the arrangement in every period and provide high quality. The first aspect is taken care of by an individual rationality (IR) constraint which amounts to

$$w + P - c \geq 0. \tag{IR}$$

Note that when relational contracts are used, an (IR) constraint equals $U \geq 0$, which is, however, identical to $w + P - c \geq 0$, given the stationarity of the game.

After signing the contract, it must be in the upstream party's interest to deliver high quality (provided it expects subsequent payment of P), which is captured by the incentive compatibility (IC) constraint:

$$P \geq c. \tag{IC}$$

Note that when relational contracts are used, an (IC) constraint equals $-c+P+\delta U \geq 0$ or $-c+P+\delta w \geq 0$. It turns out, though, that setting $w=0$ is (weakly) optimal in the relational contract, and hence, (IC) constraints also are equivalent in all regimes.

In the next sections, we derive conditions for the enforceability of P, separately analyzing the potential enforcement mechanisms.

8.2.1 Formal Spot Contracts

The parties might rely on formal spot contracts to enforce their arrangement. For those to work, it must be optimal for the upstream party to sue the downstream party in case high quality has been provided but the latter refused to pay P. Since the upstream party receives the agreed-upon price P after a positive verdict, this requires $K \leq P$. Moreover, enforceable price levels are restricted to amounts below θ. This implies that high quality can only be enforced in a spot contract for cost levels $K(\leq P) \leq \theta$.

If this condition holds, the following contract (not uniquely) maximizes the downstream party's profits. $P+w=c$, i.e. the (IR) constraint binds, and the upstream party does not receive a rent. $K \leq c$ implies $P=c$ and $w=0$; $c<K\leq\theta$ implies $P=K$ and $w=c-P$. In the first case, costs of enforcing contracts are so low that the upstream party will sue the downstream party in any case. In the second case, costs of enforcing contracts are relatively high such that a higher price is determined which makes it optimal for the upstream party to sue the downstream party in case the latter refused to pay P. Then, the ex-ante payment w is negative.

If enforcement costs are above θ, formal spot contracts cannot be used to generate high quality. In this case, the maximum enforceable price P would be below K, and the upstream party would not sue the downstream party. Hence, the latter would refuse to pay P after delivery of the intermediate good – and the upstream party not produce high quality in the first place.

Note that given $K \leq \theta$ and formal spot contracts are feasible, the downstream party never refuses to pay P on the equilibrium path, and the costs K never materialize. Then, efficiency is obtained in the relationship between upstream and

downstream party, and the latter party can reap the full surplus. Therefore, it is (weakly) optimal to use formal spot contracts whenever feasible.

8.2.2 Relational Contracts

Assume that $K > \theta$, so that downstream and upstream party cannot use spot contracts. Still, they might form a relational contract, where the downstream party makes the promise to not withhold the payment of P after high quality has been delivered. In this section, we derive conditions for a "pure" relational contract to work, and assess potential combinations in the following section. The downstream party's promise to pay P has to be credible, which is the case if paying P gives the downstream party a higher continuation payoff than refusing to do so. Put differently, if it reneges and withholds payment of P, the downstream party's continuation payoff must be sufficiently reduced. We assume that a deviation by the downstream party triggers a reversion to the static Nash equilibrium, in which high quality can subsequently not be enforced anymore.[24] Therefore, if it reneges, the downstream party will subsequently also default on its debt.[25] The downstream party's dynamic enforcement (DE) constraint determines the extent to which payment of P can be enforced within a relational contract and equals

$$-P - (1+r)D + D + \delta\Pi \geq 0. \tag{DE}$$

Using $\Pi = \frac{\theta - P - w - rD}{1-\delta}$, the (DE) constraint becomes $-P - rD + \delta(\theta - w) \geq 0$.

Since we are interested in an arrangement that maximizes the downstream party's profits, $w = 0$ and $P = c$.

8.2.3 Formal Enforcement in Long-Term Arrangement

Even if $K > \theta$, players can potentially make use of formal contracts, with the following long-term arrangement: In case the downstream party refuses to pay P despite the delivery of high quality, the upstream party sues the downstream party and is subsequently awarded P. Afterwards, the relationship continues, but continuation play is adjusted such that the upstream party's continuation profits are large enough to make up for the difference $K - \theta$. Denoting the upstream party's off-path profits

[24] This is optimal since Abreu (1988) shows that a player with an observable deviation from equilibrium behavior should optimally be punished by receiving their minmax-payoff.

[25] Note that the downstream party might also repay the loan and enter the credit market again in the subsequent period – trying to borrow more than before and then default on this larger amount. Such a devation from the downstream party's equilibrium borrowing behavior, though, would let creditors conclude that the downstream party has reneged.

by $\tilde{U}$, the condition making it optimal for the upstream party to sue the downstream party then equals

$$\theta - K + \delta\tilde{U} \geq 0. \tag{2}$$

There, we take into account that it is optimal to set P as high as possible, i.e., $P = \theta$, which implies $w = c - P$.

For this arrangement to work, a number of further constraints must hold off the equilibrium path; in particular, also the downstream party's off-path continuation profits must be large enough that it still repays debt and does not default. We pin down those constraints formally in the proof to Proposition 1. Finally, note that a dynamic enforcement constraint is not required because payment of P is ultimately enforced by a court.

8.3. Maximum Debt

Let us now analyze the downstream party's decision on how to finance the initial investment I. There, we do not solve for a uniquely optimal debt level, but rather derive the *maximum* amount of debt it can possibly use. Within our model setup, it will turn out to be weakly optimal for the downstream firm to only use (internal) equity financing (on which we impose no restrictions). But there are many reasons outside our model for why firms might use debt, for example because of associated tax benefits (which we analyze in Appendix II, in Section 8.6), or because they do not have sufficient internal funds and using external equity triggers agency costs (see Fahn et al., 2019). In these cases, the maximum debt level that we derive below is equivalent to the *uniquely* optimal debt level. In the following, we abstract from those aspects in order to isolate implicit costs of debt financing, and predict that firms facing a lower maximum debt threshold should ultimately also use less debt.

Because the credit market is competitive, the interest rate r is determined by $-D+\delta(1+r)D = 0$ and equals $r = (1-\delta)/\delta$. Then, the downstream party's profits at the beginning of the game, $\Pi_0 = -(I - D)+\delta\Pi = -I+\delta\frac{\theta-c}{1-\delta}$, are independent of the financing structure given high quality can be enforced. This is because downstream party and creditor share the same discount factor, hence the direct costs of using debt or equity financing are identical. But debt affects the downstream party's incentives who might be tempted to default to save on interest payments today – at the expense of future profits. Therefore, debt must be sufficiently small such that a default is not optimal, which is captured by the downstream party's no-default (ND) condition,

$$-rD + \delta\Pi \geq 0. \tag{ND}$$

This condition must hold irrespective of the kind of arrangement upstream and downstream party use to govern their relationship. However, only if formal spot

contracts are used, the (ND) constraint actually is relevant. With relational contracts or formal enforcement in a long-term arrangement, debt is restricted by even tighter constraints. Then, the downstream party's debt level also affects the interaction between upstream and downstream party.

First, the dynamic enforcement constraint for a relational contract equals $-P - rD + \delta\Pi \geq 0$, which is tighter than (ND). Second, with formal enforcement in a long-term arrangement, a no-default condition also must hold off the equilibrium path. In case the downstream party refused to pay P and is sued by the upstream party, the downstream party subsequently cannot keep the full surplus of the continuation game. Instead, it has to grant the upstream party a share that is sufficient to cover the difference $K - \theta$. Denoting the downstream party's off-path profits by $\tilde{\Pi}$, her off-path no-default constraint becomes $-rD + \delta\tilde{\Pi} \geq 0$. Since $\tilde{\Pi} < \Pi$, this constraint is tighter than (ND).

Finally, because the regime to enforce high effort depends on the costs of enforcing formal contracts, K, also the maximum debt threshold is a function of K. This relationship is made precise in Proposition 1:

Proposition 1 *In an equilibrium where high quality is provided in every period and the downstream party never defaults on the equilibrium path, the downstream party's* maximum *debt* $\overline{D}$ *is characterized by*

- $\overline{D}^{SC} = \delta^2 \frac{\theta - c}{1-\delta}$ *for* $K \leq \theta$,
- $\overline{D}^{LC} = \delta^2 \frac{\theta - c}{1-\delta} - \delta\left(K - \theta\right)$ *for* $\theta < K \leq \theta + c$,
- $\overline{D}^{RC} = \delta^2 \frac{\left(\theta - \frac{c}{\delta}\right)}{1-\delta}$ *for* $K > \theta + c$,

with $\overline{D}^{RC} < \overline{D}^{LC} < \overline{D}^{SC}$.

Proof of Proposition 1. The threshold $\overline{D}^{SC} = \delta^2 \frac{\theta - c}{1-\delta}$ immediately follows from plugging $r = (1-\delta)/\delta$ and $\Pi = (\theta - c)/(1-\delta) - D/\delta$ into the downstream party's no-default condition, $-rD + \delta\Pi \geq 0$. In case formal spot contracts can be used, i.e. for $K \leq \theta$, no further constraints must be considered.

In case relational contracts are used, the (DE) constraint $-P - rD + \delta\Pi \geq 0$ is tighter than the (ND) constraint and thus determines the maximum debt threshold. Plugging $P = c$, $r = (1-\delta)/\delta$ and $\Pi = (\theta - c)/(1-\delta) - D/\delta$ into the (DE) constraint gives $\overline{D}^{RC} = \delta^2 \frac{\left(\theta - \frac{c}{\delta}\right)}{1-\delta}$.

For the case of formal enforcement in long-term arrangements, we construct a profit-maximizing equilibrium (i.e., with $w+P=c$) where, although $K>\theta$, the upstream party sues the downstream party given the latter refused to pay P even though quality has been high. In the following, we denote the costs the downstream party has to bear after a verdict against her by $\tilde{K}$. Furthermore, the upstream party's off-path continuation profits are denoted by $\tilde{U}=\left(\tilde{w}+\tilde{P}-c\right)/(1-\delta)$, and the downstream party's off-path continuation profits by $\tilde{\Pi}=\left(\theta-\tilde{w}-\tilde{P}-r\tilde{D}\right)/(1-\delta)$.

Let us now derive the constraints that must hold for this to be an equilibrium. Starting with the *upstream party*, its on-path individual rationality and incentive compatibility constraints must hold (as specified above) and will bind in a profit-maximizing equilibrium. Furthermore, as pointed out above, it must be optimal for the upstream party to sue the downstream party in case the latter refused to pay P:

$$\theta-K+\delta\tilde{U}\geq 0. \tag{3}$$

In addition, it must remain optimal for the upstream party to accept the contract and provide high quality off the equilibrium path. For $\theta-K<0$, constraint (3) implies $\tilde{U}>0$, hence the upstream party accepts the off-path contract. Its off-path (IC) constraint equals $\tilde{P}-c+\delta\tilde{U}\geq 0$. There, we can set $\tilde{P}=c$ without loss of generality, so that the rent the upstream party is awarded to after a deviation by the downstream party is solely provided via the fixed payment $\tilde{w}$, then the off-path (IC) constraint holds.

For the downstream party it must not be optimal to default. On the equilibrium path, this is given by (ND). Off the equilibrium path and immediately after the deviation, this condition becomes

$$-(1+r)D+\tilde{D}-\tilde{K}+\delta\tilde{\Pi}\geq-\tilde{K}. \tag{4}$$

There, note that we assume that the downstream party cannot get around paying $\tilde{K}$ by a default, hence it enters both sides of the constraint.

In subsequent periods after a deviation, this constraint equals

$$-r\tilde{D}+\delta\tilde{\Pi}\geq 0. \tag{5}$$

Note that it is weakly optimal to set $\tilde{D}=D$, for the following reason: Taking into account that $r=(1-\delta)/\delta$, condition (4) becomes $-\frac{D}{\delta}+\delta\frac{\left(\theta-\tilde{w}-\tilde{P}\right)}{(1-\delta)}\geq 0$, and is therefore independent of $\tilde{D}$. Furthermore, condition (3) becomes $-\frac{\tilde{D}}{\delta}+\delta\frac{\left(\theta-\tilde{w}-\tilde{P}\right)}{(1-\delta)}\geq 0$. If the downstream party wants to keep debt as high as feasible (for reasons outside

our model), she will set on-path debt D to the level where condition (4) binds, i.e. $-\frac{D}{\delta}+\delta\frac{\left(\theta-\tilde{w}-\tilde{P}\right)}{(1-\delta)}=0$. Then, because $-\frac{\tilde{D}}{\delta}+\delta\frac{\left(\theta-\tilde{w}-\tilde{P}\right)}{(1-\delta)}\geq 0$, the maximum level of $\tilde{D}$ is the same as of D. If the downstream party does not want to keep debt as high as feasible, it is without loss to set $\tilde{D}=D$. This implies that conditions (5) and (4) are equivalent, hence condition (5) can be omitted.

Furthermore, the (DE) constraint now equals $-P-rD+\delta\Pi\geq -P-(1+r)D+\tilde{D}-\tilde{K}+\delta\tilde{\Pi}$, which (using $r=(1-\delta)/\delta$) becomes $\delta\frac{\theta-P-w}{1-\delta}\geq -\tilde{K}+\delta\frac{\theta-\tilde{w}-\tilde{P}}{1-\delta}$. This is automatically satisfied since $\tilde{w}+\tilde{P}\geq w+P$ and $\tilde{K}\geq 0$.

Payment of P also is optimal off the equilibrium path, since the upstream party continues to sue the downstream party in case the latter refuses to pay ((3) still holds). Hence the off-path (DE) constraint equals

$$-\tilde{P}-r\tilde{D}+\delta\tilde{\Pi}\geq -\tilde{P}-r\tilde{D}+\delta\tilde{\Pi}-\tilde{K}.$$

Off the equilibrium path it must remain optimal for the downstream party to offer $\tilde{w}$ and $\tilde{P}$ in every period. This can be supported by the following strategies:

When making an offer $\tilde{w}'+\tilde{P}'<\tilde{w}+\tilde{P}$ in one period, the upstream party expects the downstream party to also do so in all subsequent periods. Therefore, the upstream party does not deliver high quality because given it expects the downstream party to make offers below $\tilde{w}+\tilde{P}$, it will not sue the downstream party in case the latter refused to pay $\tilde{P}$. Therefore, the downstream party would not pay $\tilde{P}$ if high quality had been provided.

Hence, it is better for the downstream party to offer $\tilde{w}+\tilde{P}$ compared to a lower value (naturally, the downstream party would also prefer $\tilde{w}+\tilde{P}$ over a higher value).

Concluding, the constraints (4) and (5), $\theta-K+\delta\tilde{U}\geq 0$ and $-rD+\delta\tilde{\Pi}\geq 0$, pin down whether an equilibrium can be constructed where the upstream party sues the downstream party even though $K>\theta$. It is weakly optimal to set $\tilde{w}$ and $\tilde{P}$ as small as possible, i.e. such that condition (4) binds. Then, $\theta-K+\delta\tilde{U}=0$ and $\tilde{w}+\tilde{P}=\frac{1-\delta}{\delta}(K-\theta)+c$. Plugging this into (4) gives

$$D\leq \overline{D}^{LC}=\delta^2\frac{\theta-c}{1-\delta}-\delta(K-\theta).$$

Finally, comparing $\overline{D}^{RC}$ to $\overline{D}^{LC}$ yields that $\overline{D}^{RC}<\overline{D}^{LC}$ if and only if $K<c-\theta$. ■

The maximum debt threshold for a formal spot contract, $\overline{D}^{SC}$, directly follows from the downstream party's (ND) constraint: Debt reduces future profits because of required interest payments. If these payments are too high compared to discounted future profits, the downstream party rather sacrifices the latter and defaults. Since

formal spot contracts are only feasible for relatively low enforcement costs K, $\overline{D}^{SC}$ is the effective maximum-debt threshold in this case.

$\overline{D}^{RC}$ follows from the downstream party's (DE) constraint. It is smaller than $\overline{D}^{SC}$ because of a direct interaction of the downstream party's relationships with creditor and upstream party. The downstream party's commitment in each relationship is given by the difference between its future on- and off-path rents. Interest payments on debt reduce future on-path rents without affecting off-path rents, as the downstream party also defaults after reneging on the relational contract. Therefore, debt allows the downstream party to share its costs of reneging with the creditor.

Formal enforcement in a long-term arrangement is an intermediate case. It only works if the productive relationship continues after the downstream party refused to pay P and is subsequently sued, because the upstream party is only willing to sue the downstream party if it receives a share of the continuation surplus. This reduces the downstream party's off-path rents and therefore increases its temptation to default after being sued.

If enforcement costs are only slightly above θ, formal enforcement in long-term arrangements is, ceteris paribus, easier to enforce than relational contracts, because the increase in the downstream party's off-path default temptation is only moderate. The benefits provided by formal enforcement then outweigh the increased default temptation. If enforcement costs are rather large, however, the off-path rent that has to be given to the upstream party is so large that the players rather forego the benefits of formal enforcement and use relational contracts.

8.4. Discussion of Assumptions

In this section, we discuss some of the assumptions we have imposed on contractability. Our specification of formal contracting follows the description of the hypothetical case behind the measure of contract enforcing costs we use in our empirical analysis. This measure considers costs that must be *advanced* by the upstream party when filing the lawsuit, no matter whether those are reimbursed or not. In our model, however, K must be borne by the upstream party, even if it wins the lawsuit. Hence, these costs are net of expenses that potentially are reimbursed by the downstream party after a positive court decision.

We think that legal expenses that must be advanced by the upstream party are a good proxy for its final expenses, for the following reasons. First, higher costs that must be advanced by the upstream party should generally translate into higher costs that must finally be borne by the upstream party even in jurisdictions in which the loser of a trial has to reimburse the winner's expenses. Although we assume that the

upstream party wins with probability 1 (following the hypothetical case described in the empirical section), in reality there will always be some uncertainty. Incorporating uncertainty would not affect the basic structure of the optimal arrangement in our model, though, as all players are risk neutral. Therefore, even if it is reimbursed for its expenses after a victory, the upstream party will in some cases still have to bear those costs. Second, since the maximum litigation value is θ (an aspect we are going to discuss in the next paragraph), it is not possible to arbitrarily adjust the contracted price P upward in order to fully internalize any expected costs.

We restrict the litigation value by θ, the maximum price that is enforced by a court. The exact upper bound of court-enforceable prices is not relevant, as long as there is one – and θ seems like a natural value. If there was no upper bound on court-enforceable prices, enforcement cost K would become irrelevant (by setting P very high and making up for it with a low negative ex-ante payment w). Furthermore, no additional "liquidated damages" which the party breaching the contract must pay to the other party are enforced. These restrictions on the contracting space can be justified by two aspects. First, courts usually do not enforce liquidated damages that appear excessive relative to actual damages. In other words, if a liquidated damage appears to be rather a penalty for contract-breach, it is generally turned down by courts (see Farnsworth, 2004, or Posner, 2011). Second, a high ex-post payment would only be optimal for the downstream party if it was accompanied by a low negative ex-ante payment. If we assumed a limited liability constraint on the upstream party's side (a standard assumption in the agency literature), though, this option would not be available. Such a limited liability constraint would only slightly affect our results, however complicate the analysis. To keep it simple, we assume instead that enforceable prices are bounded.

Finally, we assume that the downstream party can keep the intermediate good in any case, even after refusing to pay the price P and *not* being sued by the upstream party afterwards. This assumption can be endogenized by introducing an additional bargaining stage over ownership of the good after the downstream party refused to pay the contractual price P. Because the outside value of the intermediate good is zero, the upstream party would accept any positive offer by the downstream party.

8.5. Proof of Prediction 2

Proof of Prediction 2. Taking the derivative of the downstream party's debt threshold with respect to the discount factor yields

$$\begin{aligned}\frac{d\overline{D}^{SC}}{d\delta} =& \delta\frac{2-\delta}{(1-\delta)^2}(\theta-c) \text{ and}\\ \frac{d\overline{D}^{RC}}{d\delta} =& \frac{\delta(2-\delta)\theta-c}{(1-\delta)^2},\\ \Rightarrow& \frac{d\overline{D}^{RC}}{d\delta} < \frac{d\overline{D}^{SC}}{d\delta}.\end{aligned}$$

Moreover, $d\overline{D}^{RC}/d\delta > 0$, $d\overline{D}^{LC}/d\delta > 0$ and $d\overline{D}^{SC}/d\delta > 0$.

Since a higher K lets more firms rely on relational contracts compared to formal contracts the prediction follows for these two enforcement mechanisms. Finally, $\overline{D}^{LC} = \delta^2\frac{\theta-c}{1-\delta} - \delta(K-\theta)$ implies $\frac{d^2\overline{D}^{LC}}{d\delta dK} = -1$.

■

8.6. Profit Tax

In the main section, we assume that the direct costs of debt and equity financing are identical. Given interest rates are tax-deductible, though, debt is often regarded as effectively being cheaper than equity. Extending our model in this direction, we find that the downstream party should use as much debt as possible to maximize tax shields. Still, debt must not exceed a threshold above which a default becomes optimal. Compared to the analysis above, this threshold will not be affected by the tax level, thus the firm's uniquely optimal financing strategy involves a debt level that is exactly at the respective threshold (provided it is smaller than I).

Assume profits are taxed with the rate τ and that interest payments (as well as enforcement costs) can be deducted from taxable income. Furthermore, the interest paid to creditors still is $r = \frac{1-\delta}{\delta}$ (we hence abstract from potential taxes creditors have to pay on income from interest payments). Besides taxes, the environment is as before. Therefore, the downstream party's profits on the equilibrium path are $\Pi = \frac{(\theta-c-rD)(1-\tau)}{1-\delta}$ and $\Pi_0 = -(I-D) + \delta\Pi = -I + \tau D + \delta\frac{(\theta-c)(1-\tau)}{1-\delta}$. Since $\partial\Pi_0/\partial D > 0$, ceteris paribus the downstream party should borrow as much as possible. Taking into account the constraints that must hold to guarantee the provision of a high-quality intermediate good in every period, we get

Proposition 2 *:* Assume firms face a profit tax τ. Then, the downstream party's **uniquely** optimal debt level $\hat{D}$ equals

- $\hat{D}^{SC} = min\left\{I,\, \delta^2 \frac{\theta - c}{1-\delta}\right\}$ *for* $K \leq \theta$
- $\hat{D}^{LC} = min\left\{I,\, \delta^2 \frac{\theta - c}{1-\delta} - \delta\left(K - \theta\right)\right\}$ *for* $\theta < K \leq \theta + c$
- $\hat{D}^{RC} = min\left\{I,\, \delta^2 \frac{\left(\theta - \frac{c}{\delta}\right)}{1-\delta}\right\}$ *for* $K > \theta + c$,

with $\hat{D}^{RC} \leq \hat{D}^{LC} \leq \hat{D}^{SC}$.

Proof of Proposition 2. Making use of the results we derived above (in case no profit tax is present), the downstream party's objective is to maximize $\Pi_0 = -\left(I - D\right) + \delta\Pi = -I + \tau D + \delta\frac{(\theta - c)(1-\tau)}{1-\delta}$, subject to the relevant constraints.

We first show that those constraints are independent of τ:

In case formal spot contracts are used, debt is restricted by the no-default (ND) constraint. This becomes

$$\left(\theta - c - rD\right)\left(1 - \tau\right) + \delta\frac{\left(\theta - c - rD\right)\left(1 - \tau\right)}{1 - \delta} \geq \left(\theta - c\right)\left(1 - \tau\right), \tag{ND}$$

since taxes must also be paid off the equilibrium path. Hence, $(1-\tau)$ cancels out and the (ND) constraint is independent of τ.

In case relational contracts are used, debt is restricted by the dynamic enforcement (DE) constraint. This becomes

$$\left(\theta - c - rD\right)\left(1 - \tau\right) + \delta\frac{\left(\theta - c - rD\right)\left(1 - \tau\right)}{1 - \delta} \geq \theta\left(1 - \tau\right), \tag{DE}$$

hence $(1-\tau)$ cancels out as well.

Finally, concerning formal enforcement in long-term arrangenement, we showed in the proof to Proposition 1 that maximum debt is determined by the off-path rent the upstream party must be granted in order to sue the downstream party after the latter refused to pay P. This constraint equals $\left(w - c + P - K\right)\left(1 - \tau\right) + \delta\frac{\left(\tilde{w} + \tilde{P} - c\right)(1-\tau)}{1-\delta} \geq 0$, where we implicitly assume that losses and the resulting tax shields can be carried forward (since $w - c + P = 0$, the effective enforcement costs are reduced by the factor τ). Taking into account that this constraint optimally binds, i.e., $\tilde{w} + \tilde{P} = \frac{1-\delta}{\delta}\left(K - \theta\right) + c$, the downstream party's off-path profits are

$\tilde{\Pi} = \frac{\left(\theta - \tilde{w} - \tilde{P} - rD\right)(1-\tau)}{(1-\delta)}$. Plugging this into the downstream party's off-path no default constraint,

$$\left(\theta - c - rD - \tilde{K}\right)(1-\tau) + \delta \frac{\left(\theta - \tilde{w} - \tilde{P} - rD\right)(1-\tau)}{(1-\delta)} \geq \left(\theta - c - \tilde{K}\right)(1-\tau),$$

gives $D \leq \delta^2 \frac{(\theta - c)}{(1-\delta)} + \delta(\theta - K)$, which is equivalent to above.

Since Π_0 is increasing in D, debt should be as high as feasible. The remainder, in particular the aspect which debt level is relevant for which size of enforcement costs K, follows from the proof to Proposition 1. ■

If firms face a proportional profit tax, the downstream party's optimal debt level is as high as possible. Interestingly, though, (DE) and no-default constraints (which pin down maximum feasible debt), are unaffected by the profit tax because those are deducted from on- and off-path profits and hence cancel out. Therefore, *optimal* debt levels with a tax are just the same as *maximum* debt levels without a tax.

8.7. Investment by Upstream Party

In this section, we show that our results go through if also the upstream party has to make a physical investment at the beginning of the game. Then, the downstream party's maximum debt threshold when using a relational contract still is strictly smaller than when using a formal contract. Concerning the upstream party, the resulting maximum debt threshold is weakly smaller when using a relational than when using a formal contract. Note that having the upstream party make an ex-ante investment implies that the downstream party cannot extract the whole rent because the upstream party would never make a costly investment if it was not sufficiently covered by future payoffs. Therefore, we also show in this section that our results do not rely on the downstream party keeping the whole rent generated in its relationship with the upstream party.

In the following, we assume that the also the upstream party has to make an ex-ante investment, denoted I_{up} (the downstream's investment still is denoted I), and that the amount of debt it uses is denoted D_{up} (D still is the downstream party's debt level). Furthermore, the upstream party now can keep a share $\alpha \in (0, 1)$ of the total relationship surplus, $\frac{\theta - c}{1-\delta}$, whereas the downstream party secures a share $1 - \alpha$ (this allocation might for example be caused by a bargaining process at the beginning of every period). We impose no assumptions on the size α, only that it leaves upstream and downstream party enough rent to render their ex-ante investments optimal. This implies that on-path payoffs are $\Pi = \frac{P + w - c}{1-\delta} = \frac{(1-\alpha)(\theta - c) - rD}{1-\delta}$ (downstream party) and $U = \frac{\theta - P - w}{1-\delta} = \frac{\alpha(\theta - c) - rD_{up}}{1-\delta}$ (upstream party).

In the following, we will derive maximum debt thresholds for both parties for the two contractual arrangements formal spot and relational contracts (here, we abstract from formal enforcement in a long-term arrangement). There, we can omit the upstream party's (IR) condition, $U \geq 0$, which is automatically satisfied given starting its business is optimal for the upstream party (which is the case if $-I_{up} + D + \delta U \geq 0$ and $D \leq I_{up}$).

Formal Spot Contract

Here, we assume that upon not delivering high quality, the relationship is terminated (which is optimal following Abreu, 1988). Therefore, the upstream party's (IC) constraint equals

$$-c + P - rD_{up} + \delta U \geq 0. \tag{IC}$$

Taking into account $r = \frac{1-\delta}{\delta}$, this yields a a debt threshold $D_{up} \leq D_{up}^{FC} = \delta \frac{(P-c)(1-\delta)+\delta\alpha(\theta-c)}{1-\delta}$. The downstream party's no-default condition, $-rD + \delta\Pi \geq 0$, gives the downstream party's maximum debt threshold,

$$D \leq D^{FC} = \frac{\delta^2 (1-\alpha)(\theta-c)}{1-\delta}.$$

Hence, it is weakly optimal to set $P = \theta$ (this increases D_{up}^{FC} without affecting D^{FC}), therefore

$$D_{up}^{FC} = \delta \frac{(\theta-c)(1-\delta+\delta\alpha)}{1-\delta}.$$

Relational Contract

As with formal contracts, the upstream party's (IC) constraint equals $-c + P - rD_{up} + \delta U \geq 0$ and gives a debt threshold

$$D_{up} \leq D_{up}^{RC} = \delta \frac{(1-\delta)(P-c) + \delta\alpha(\theta-c)}{1-\delta}.$$

Here, however, it is not necessarily optimal to set $P = \theta$, because a larger P also reduces the downstream party's maximum debt threshold. This threshold is obtained by the dynamic enforcement constraint, $-P - rD + \delta \frac{(1-\alpha)(\theta-c)-rD}{1-\delta} \geq 0$, which yields

$$D \leq D^{RC} = \delta \frac{\delta(1-\alpha)(\theta-c) - P(1-\delta).}{1-\delta}$$

For given debt levels and if this is feasible, $P \in [c, \theta]$ will be designed such that both constraints hold. However, since $P \leq \theta$, $D_{up}^{RC} \leq D_{up}^{FC}$, whereas $P \geq c$ still implies $D^{RC} < D^{FC}$.

Therefore, the downstream party's maximum debt threshold is still strictly smaller under a relational than under a formal spot contract. The upstream party's maximum debt threshold is weakler smaller under a relational than under a formal spot contract.